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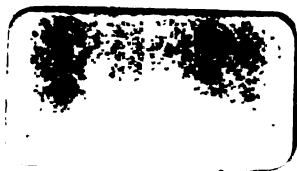
AIRCRAFT YEAR BOOK



1922



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AIRCRAFT YEAR BOOK, 1922



Aeromarine Cruiser "*Santa Maria*," two 400 h.p. Liberty engines, on return to New York after two years' operation, covering 30,000 miles. Photo, Hamilton Maxwell.

AIRCRAFT "YEAR BOOK



1922

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TABLE OF CONTENTS

CHAPTER	PAGE
I Review of Commercial Aviation During the Year—Aircraft Demonstrate Practical Utility—Significance of Aircraft Battleship Demonstrations—Air Law in Sight—Aeronautical Chamber of Commerce Organized	I
II Problems of Aerial Transportation—Capital, Terminals, Reliability—Needs Which Can Be Met Through Aerial Law—Report to Secretary of Commerce on Safety in Flight .	32
III The Air Demonstrates Its Command of the Sea—The Battleship Bombing and the Conference on the Limitation of Armaments	45
IV Review of Aeronautics Throughout the World, Nation by Nation	60
V Technical Progress in Aircraft Construction During the Year	99
VI Airships in Commerce	107

HISTORICAL DESIGN SECTION

APPENDIX

COMMERCIAL SECTION

Aeronautical Chamber of Commerce of America, Inc.	161
Manufacturers Aircraft Association, Inc.	166

U. S. AIR SERVICE, WAR DEPARTMENT

Organization	167
Officers on Duty in Washington	167
Army Corps Areas and Departments	168
Stations and Activities	169

BUREAU OF AERONAUTICS, NAVY DEPARTMENT

Organization	172
Officers on Duty in Washington	172
Officers with the Fleets	173
Naval Air Stations	173

	PAGE
MARINE CORPS, NAVY DEPARTMENT	
Organization	174
Officers	174
Aviation Stations	174
STRENGTH OF U. S. AIR FORCES (ARMY, NAVY, MARINE CORPS) .	175
DIPLOMATIC SERVICE OF THE U. S.	
Air Attaches, War Department	175
Air Attaches, Navy Department	175
DIPLOMATIC SERVICE TO THE U. S.	
Foreign Air Attachés	175
AERONAUTICAL BOARD	
Personnel and Committees	176
HELIUM BOARD	177
BOARD OF SURVEYS AND MAPS, DEPARTMENT OF INTERIOR . . .	177
AIRCRAFT APPROPRIATIONS, FOREIGN	178
AIRCRAFT APPROPRIATIONS, U. S.	
Military	179
Naval	179
Postal	179
AIRCRAFT PRODUCTION COST, 1917-1918	180
FOREIGN SUBSIDIES FOR CIVILIAN AVIATION	197
ARMAMENT CONFERENCE REPORT ON AIRCRAFT	198
AIR MAIL SERVICE, POST OFFICE DEPARTMENT	
Executives	212
Air Mail Fields	212
Transcontinental Controls	212
Planes in Service	213
Consolidated Statement of Performance, May 15, 1918-Dec. 31, 1921	214
FOREST FIRE PATROL, DEPARTMENT OF AGRICULTURE	216
NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS	
Organization	217
Summary of Report	218
President's Letter of Transmittal	219
CUSTOMS REGULATIONS, TREASURY DEPARTMENT	220
PUBLIC HEALTH SERVICE, TREASURY DEPARTMENT	220

CONTENTS

vii

	PAGE
AIRCRAFT IMPORTS AND EXPORTS	221
BUREAU OF STANDARDS, DEPARTMENT OF COMMERCE	222
BUREAU OF FOREIGN AND DOMESTIC COMMERCE, AUTOMOTIVE DIVISION, DEPARTMENT OF COMMERCE	222
AIR LAW SECTION	
Wadsworth Bill, creating Bureau of Civilian Aeronautics in Department of Commerce	223
Fake Stock Warning, National Vigilance Committee, Associated Advertising Clubs of the World	226
AIRCRAFT INSURANCE	
National Aircraft Underwriters' Association	229
COLLEGES AND SCHOOLS OFFERING COURSES IN AERONAUTICS	230
LANDING FIELDS AND AIR TERMINALS	230
CHRONOLOGY FOR 1921	232
REMARKABLE AERONAUTICAL PERFORMANCES, 1920	243
WORLD'S RECORDS, 1921	244
TRADE INDEX	247

ILLUSTRATIONS

Aeromarine Cruiser " <i>Santa Maria</i> "	<i>Frontispiece</i>
	FACING PAGE
Curtiss Navy Racer	6
Dayton Wright Forest Patrol Seaplane	7
Larsen J.L.-6 Monoplane	12
Loening Monoplane " <i>Flying Yacht</i> "	13
Lieut. J. Macready and Packard-Lepere	16
Thomas-Morse M.B.-7	17
Laird " <i>Swallow</i> "	22
Longren Commercial	22
Elias Commercial	23
Sperry " <i>Sport Messenger</i> "	23
Curtiss " <i>Wildcat</i> "	26
Dayton Wright " <i>Chummy</i> "	27
Gallaudet Multiple Drive	34
Aeromarine Cruiser at Havana	35
Secretary of War Inspecting Martin Bomber	44
Bombing of ex-German submarine " <i>U.-117</i> "	45
Sinking of ex-German destroyer " <i>G.-102</i> "	48
Bombing of ex-German cruiser " <i>Frankfurt</i> "	49
Ex-German Dreadnought " <i>Ostfriesland</i> " Before Attack	54
Bombing of " <i>Ostfriesland</i> "	55
The last of the " <i>Ostfriesland</i> "	58
Phosphorus Bomb hits " <i>Alabama</i> "	59
Final Plunge of the " <i>Alabama</i> "	66
Larsen J. L.-6 in Canada	67
Army Plane Spraying Grove	67
Airplane Patrol over Plumas National Forest	70
Timber Fire Seen from Air	70
Flying Festival, Curtiss Field	71
Shore Line, Westchester County, New York	74
Examples of Aerial Advertising	75
Pennsylvania Railroad Utilizes Aerial Photography	82
Mount Washington from the Air	83
Woolworth Building, New York	86
Aerial Photograph Aids Litigation	87
Aerial Advertising for United American Lines	87
Aeromarine A.S.-2 Naval Seaplane	102
Curtiss C.T. Navy Torpedo Plane	103
Easter Airways Flying Boat " <i>Lady Baltimore</i> "	106
Vought V.E.-7	106
Interior Dayton Wright Forest Patrol Seaplane	107
Thomas-Morse M.B.-6 Biplane	107
L.-59 Airship of Luftschiffbau-Zeppelin	114
Views of Luftschiffbau-Zeppelin Commercial Airship " <i>Bodensee</i> "	115
Marshal Foch at American Legion Flying Meet	166
Air Mail Landing in the Rockies	166
Loening " <i>Flying Yacht</i> " Taking Off	167
Aerial View of Muscle Shoals Power Project	167

INTRODUCTION

The Aeronautical Chamber of Commerce of America, Inc., has taken over the editing and publishing of the Aircraft Year Book. In presenting the volume for 1922, we desire to express our appreciation to the Manufacturers Aircraft Association, Inc., for the informative and historical work begun three years ago and permanently recorded in the Aircraft Year Books of 1919, 1920 and 1921.

Preparation of the 1922 issue was made possible through the co-operation of Major Horace M. Hickam, Chief, Information Division, U. S. Air Service; Captains Burdette S. Wright and St. Clair Streett, Air Ways Section, U. S. Air Service; Major Thurman H. Bane, Engineering Division, U. S. Air Service; Commander V. K. Coman, Administration Division, Bureau of Aeronautics, Navy Department; Lieutenant W. L. Richardson, Flight Division, in charge of Photography, Bureau of Aeronautics, Navy Department; Colonel Paul Henderson, Second Assistant Postmaster General and Carl F. Egge, Superintendent of the Air Mail; Mr. Gordon Lee, Chief, Automotive Division, Bureau of Foreign and Domestic Commerce, Department of Commerce; Mr. G. W. Lewis and J. F. Victory, National Advisory Committee for Aeronautics; and the Pan American Union.

Chapter V, "Technical Progress in Aircraft Construction During the Year," is contributed by Paul G. Zimmermann, Chief Engineer for the Aeromarine Plane and Motor Company, Keyport, N. J., and G. J. Mead, Chief Engineer, Wright Aeronautical Corporation, Paterson, N. J.; C. H. Colvin, Pioneer Instrument Company, Brooklyn, N. Y., and Sherman M. Fairchild, Fairchild Aerial Camera Corporation, New York City, to whom special acknowledgments are due.

AERONAUTICAL CHAMBER OF COMMERCE OF AMERICA, INC.

New York City, May 10, 1922.

AIRCRAFT YEAR BOOK, 1922

CHAPTER I

COMMERCIAL AIRCRAFT DEMONSTRATE PRACTICAL UTILITY
—SIGNIFICANCE OF AIRCRAFT—BATTLESHIP DEMONSTRATIONS—AIR LAW IN SIGHT—AERONAUTICAL CHAMBER OF COMMERCE OF AMERICA ORGANIZED

IN aviation, the year 1921 is marked by three outstanding events, one of universal and epochal importance.

During June and July there were held, 100 miles off the Virginia Capes, a series of experiments in the course of which aircraft flown from land bases, bombed and sank, one after the other, a submarine, destroyer, light cruiser and dreadnought, the most modern examples of warship construction.

In the fall the Conference on the Limitation of Armament was held in Washington, and it is asserted that the bombing tests cleared the way, more than any other single event, for a possible solution of the international competition in capital ship construction. For the 2000 pound TNT bomb which crushed in the steel walls of the "*Ostfriesland*" was, as the Army Chief of Ordnance remarked at the moment, "heard around the world."

HARDING URGES AIR LAW

Commercial aviation, struggling for nearly three years without the assistance of a national policy, found an intelligent and sympathetic friend in the Harding administration. The President in his inaugural address urged the early enactment of an Aerial Code and the consistent encouragement of civilian flying. In consequence there was drafted a bill regulating the operation of aircraft in interstate and foreign commerce, and establishing a Bureau of Civilian Aeronautics in the Department of Commerce. This bill, introduced by Senator Wadsworth, passed the Senate, and at the time of publication of this volume was before the House Committee on Interstate and Foreign Commerce.

AERONAUTICAL CHAMBER OF COMMERCE FORMED

Possibly the most definite proof of growth in interest in commercial aviation, was the establishment, late in the year, of the Aeronautical Chamber of Commerce of America. The need for such an organization had long been felt. With definite assurance that an Aerial Code would shortly be established, manufacturers of heavier and lighter-than-air craft, motors, parts, accessories, materials and supplies; dealers, distributors, operators and owners; associations, corporations, firms and individuals engaged in the commercial phases of the art, decided to equip themselves with a national organization of the type which had proved so useful in the development of other American industries.

The Aeronautical Chamber of Commerce was incorporated under the laws of the State of New York, "to foster, advance, promulgate and promote" aeronautics, and "generally, to do every act and thing which may be necessary and proper for the advancement" of American aviation. Formal organization was announced on Dec. 31, 1921, with a charter membership of 100. At the time of publication membership had increased to 185, including such pioneers as Orville Wright and Glenn H. Curtis, and embracing practically every important aircraft manufacturing unit in the United States.

AIRCRAFT DEMONSTRATE UTILITY

Commercial aircraft, in 1921, definitely began the demonstration of practical utility. The business man who in 1919 was merely curious, and in 1920 was interested, became convinced in 1921 that aerial transportation was no longer fancy but fact. More miles were flown, more paid passengers booked and more package freight and goods carried.

Here are the figures; let them speak for themselves:

COMPARATIVE COMMERCIAL AIRCRAFT OPERATIONS, 1920-1921

	1920	1921
Estimated number of aircraft in operation.	1000	1200
Estimated total mileage	6,000,000	6,250,000-6,500,000
Operating companies reporting	88	125
Equipment of these companies (aircraft) ..	365-425	500-600
Mileage flown by these companies	3,136,550	*2,907,245
Number of passengers carried.....	115,163	122,512
Pounds of freight carried	41,390	123,227
Number of flights by operating companies..	Unknown	130,736

* Decrease explained by less free and more paid flights.

	1920	1921
Average duration of flights	Unknown	21 minutes
Average charge for short flights	\$12.50	\$9.00
Average charge per mile for inter-city flights .....	.65	.55
Average charge per pound for freight	Unknown	.33
States in which operations were carried on	32	34
Air terminal facilities	128	146

FLYING INCREASES 20 PER CENT

The foregoing is believed by the Aeronautical Chamber of Commerce to be accurate. The census of craft, in the absence of Federal law requiring registration, is based upon the statements of 125 established operators, upon Air Service and Naval estimates, and upon the personal observations of representatives of the Chamber throughout the country. The 1200 craft in operation represent an increase of 20% over the figures for 1920, and, generally speaking, this percentage of increase is noted throughout.

Approximately one-half the equipment was controlled by established organizations, the other half being in the hands of the gypsy flier, the care-free and often too careless itinerant, whose wanderings from coast to coast and from Mexico to Alaska have done a certain amount of good but probably much more harm. It being known that the operators at fixed points covered approximately 3,000,000 miles, carrying about 122,500 passengers, it is estimated that, all told, rather more than 250,000 persons flew and that, counting the wanderings of the gypsy, 6,500,000 miles were compassed by commercial aircraft during the year.

USES TO WHICH AIRCRAFT ARE PUT

The most valuable service which aircraft provide is speed. Conjoined with this is their unique ability to operate independently of land or water, dominating both in time of war, and capable of adaptation in time of peace to a multitude of novel uses limited only by ingenuity and commercial and industrial needs.

The following visualizes the service of the airplane and airship:

National

National Defense (Army, Navy, Marine Corps)
 Air Mail
 Forest Patrol
 Coast Guard
 Customs and Revenue Service
 Agricultural Survey
 Coast and Geodetic Survey
 Scientific Observation
 Warning and Relief in Disaster

Civic

City planning
 Road and building construction
 Rail and water terminal problems
 Fire and police zoning
 Park improvement

Commercial

Passenger service
 Freight transportation
 Messenger service in banking
 Surveying
 Aerial photography
 Engineering
 Collection and dissemination of news
 Advertising and publicity
 Sport and pleasure
 Commuting

"COMMERCE DEMANDS SPEED"

"Commerce Demands Speed; Flying is the Answer," is the timely and original trade phrase being urged by one of the operators, the Diggins Aviation Company, of Chicago. "Less Waste, More Speed," is the reply which Commerce makes, through Samuel M. Felton, president of the Chicago Great Western Railroad, and during the war Director-General of Transportation for the A.E.F.

The airplane man, alive to what is undoubtedly the most vexing of all contemporary business problems, conceives the greatest commercial need to be swifter dispatch. The railroad man, equally conscious of the need, but schooled with practical experience, demands economy. This is the challenge to commercial aircraft and it is significant of the immediate future that, in 1921, improvement in construction, decrease in operating costs and increase in the factor of safety and reliability, went far toward establishing the commercial aerial transportation business upon a sound financial basis, with but one thing lacking, and that about to be provided—the enactment by Congress of an Aerial Code.

Commerce is the same in principle, whether carried on in a thickly populated territory, well equipped with the most improved means of transportation, or whether in sparse regions poorly served, if at all, by conveyances on road, rail and water. Commerce is satisfactory only when conducted with dispatch, and there are circumstances and conditions under which commerce will gladly pay an increased tariff for increased speed.

The correctness of this statement is apparent upon the analysis of the following table showing aircraft operations by states:

AIRCRAFT OPERATIONS BY STATES

State	1920	1921	Increase	Decrease
Alabama	1	0		1
California	8	10	2	
Colorado	3	1		2
Connecticut	1	1		
Florida	3	3		
Georgia	2	0		2
Idaho	0	1	1	
Illinois	2	8	6	
Indiana	7	1		6
Iowa	3	4	1	
Kansas	0	6	6	
Kentucky	0	1	1	
Louisiana	1	1		
Maine	0	1	1	
Massachusetts	1	3	2	
Minnesota	2	2		
Missouri	1	6	5	
Montana	0	2	2	
Nebraska	0	3	3	
Nevada	0	1	1	
New Hampshire	1	1		
New Jersey	4	5	1	
New Mexico	1	0		1
New York	9	15	6	
North Carolina	2	0		2
North Dakota	0	1	1	
Ohio	7	6		1
Oklahoma	2	5	3	
Oregon	3	1		2
Pennsylvania	1	4	3	
South Carolina	0	1	1	
South Dakota	1	5	4	
Tennessee	1	0		1
Texas	2	12	10	
Utah	1	0		1
Vermont	2	1		1
Virginia	1	2	1	
Washington	7	6		1
West Virginia	0	1	1	
Wisconsin	3	3		
Wyoming	2	0		2

States Operated in 1920—32

States Operated in 1921—34

States Showing Decrease in Operations—13

States Showing Increase in Operations—22

(Note—Canada reported in 1920 but not in 1921.)

WHERE GROWTH WAS GREATEST

The greatest growth in commercial aerial transport has been in those parts of the country where the volume of traffic requiring rapid transit is such as to choke available surface facilities or where, surface facilities being antiquated, available traffic seeks other means of movement. In both cases Commerce willingly pays a premium.

The first, and at the present time the only, regularly operated aerial transportation line in the United States, and the largest in the world, utilizing flying boats exclusively, is Aeromarine Airways, Inc., the service of which covers the Florida Straits, between Florida and Cuba, and various points in the Caribbean Sea. The history of this company is an inspiring example of faith and courage. The Key West-Havana route was selected in 1920, first, because of the extraordinary volume of traffic, pleasure and business the year round; second, because passage of the stormy Channel required an entire night of discomfort, and, third, as the course lay over water, operation need not await the establishment of terminals or routes or even the enactment of Federal Law.

Starting with one eleven-passenger cruiser, the fleet has been steadily increased until, at the close of 1921, it embraced thirty flying boats of various capacity, the area of operations being extended north along the Atlantic seaboard to Boston, and westward, over the Hudson and the Great Lakes to Chicago and Detroit; south through the Mississippi Valley to New Orleans, thence around the Gulf Coast to the Key West base. During 1921, Aeromarine Airways flew 95,020 miles, according to their log, carrying 6814 passengers and 29,002 pounds of freight. They operated their Cuban service daily, making a total of 162 flights during the season, maintaining an average scheduled time of 96 minutes for the 110 miles, and this frequently notwithstanding the gales which sweep the Straits. And what is most important of all, there has never been a single person—passenger or employee, injured.

POPULATION DEMANDS SERVICE

The table showing operations by states illustrates that the pressure upon the surface facilities in Illinois, Massachusetts, New Jersey, New York, Pennsylvania, etc., has encouraged the establishment of eighteen new aircraft operators, all of which engage in occasional transport between cities, but which are handicapped in their endeavors to establish regular service, as will be explained later, by the absence of landing facilities, properly disseminated weather reports,



Curtiss Navy Racer, Curtiss 400 h.p. C. D.-12 engine; winner of 1921 Pulitzer race; speed 176.7 m.p.h. on closed course of 153.59 miles—a world's record. On Nov. 22 this plane set a new record for straight flight of 197.8 m.p.h.



Dayton Wright F. P.-2, two 400 h.p. Liberty engines, developed for forest patrol in Canada.

and Aerial Law, which is primary to the legitimate general capitalization.

In California, Idaho, Iowa, Kansas, Kentucky, Maine, Missouri, Montana, Nebraska, Nevada, North Dakota, Oklahoma, South Carolina, South Dakota, Texas, Virginia and West Virginia, where distances are great and surface facilities backward, commerce is willing to utilize aircraft. For the same service which appeals to the great business establishments of New York or Chicago, eager to hasten delivery and speed collection, appeals likewise to the small community the progress of which manifestly rests upon the rapidity with which it releases itself from isolation and establishes quick contact with purchasing territory hitherto unattainable.

THE 125 PIONEERS

Limitations of space make it impossible to treat individually the operations of each of the 125 companies whose performances are given in Table No. I. Each is a pioneer, performing a task not only for himself but for the art. Embarrassed by the gypsy, whose irresponsible flittings have left a trail of fear as well as astonishment, hampered by meager capital which hesitates so long as Federal regulation is lacking, discouraged by skepticism, these men have, nevertheless, stuck to their tasks, just as did the motor car and railroad pioneer, and they are beginning to see the justification of their faith.

Out of the 125 listed, 36 did probably three-fourths of the transportation business, and probably nine-tenths of the incidental services, such as photography, surveying, advertising, etc. Out in Montana, where business, as in the other Mountain states, has been remote from the centers of East and West alike, Earl T. Vance (Miles City Aero Club) has established commercial flying as a recognized factor. Similar success has been achieved, under equally trying circumstances, by the Concord (N. H.) Aircraft Company, operating in the White Mountains.

Of the 1200 aircraft in business use, probably more than two-thirds are Curtiss. In addition, there are the consistently progressive activities of the Curtiss Aeroplane and Motor Corporation and the Curtiss-Metropolitan Airplane Company, in New York; the Curtiss-Eastern Airplane Corporation, in Pennsylvania; the Curtiss-Indiana and Curtiss-Iowa companies in the states named, and the Curtiss-Northwest, in Minnesota.

These companies alone operated direct through a score of states from the Atlantic Seaboard to the Pacific Coast and from Canada to Cuba. They report having carried close to 25,000 passengers in the



**CURTISS NORTHWEST
AIRPLANE CO.**
MINNEAPOLIS or ST. PAUL
(Curtiss N. W. Airport)

To _____

AND RETURN

AGREEMENT

1. The airplane has thereby to leave or land at any place, to return to, or land at any place for any reason at the discretion of the pilot and to deviate from the voyage for any of the purposes mentioned.

2. If the airplane is prevented from proceeding in the ordinary course, the owner or his agent or pilot may forward the passengers named in this contract by another airplane, whether of this line or not and whether bound to the same destination or not, or by other means of transportation, the airplane owner paying railroad or other fare, or like expense to the point of destination.

3. Neither the airplane owner, pilot or passage broker shall be liable to any passenger carried under this contract for his loss, damage or delay to the passenger or his baggage arising from the act of God, public enemies, strikes or strikings of public authorities or rulers of people, fire, collision, perils of air navigation or perils of any kind, accidents in or from machinery, motor power, engine, electricity, steering apparatus, wings or any part of the airplane, latent defects even though existing at the beginning of the voyage, or from causes of any kind beyond the carrier's control even though the loss, damage or delay may have been caused or contributed to by the neglect or default of the airplane owner, servants, or of other persons the whose act he would otherwise be responsible and whether occurring on board this or any other airplane, railroad, train or other vehicle on which the passengers may be forwarded under this contract.

4. This ticket is good only for the airplane and for the date named and is evidence of the passenger's contract for transportation. It may be granted when required and given up on demand before or at the end of the voyage.

5. It is understood and agreed that the airplane owner, pilot, agent or passage broker shall not be responsible in any way whatever for loss of or damage to baggage or personal effects of any kind including that carried by hand after the same is loaded.

6. The passengers named in this contract have assumed and do hereby assume all risks and perils incident to their transportation by airplane, loss in event of loss, or damage, or delay to the passengers or their baggage on account thereof, neither the airplane owner, agent, pilot, or passage broker shall be liable therefor.

Name _____

Name _____

FROM
By Air
TO



By Air to Everywhere

DATE

NAME

To

BY AIR

WALTER T. VARNEY (Aéroplanes) SAN FRANCISCO

THE REPRESENTATIVE OF THE AIR TRAVELLER.

5c FOR 1/2 AIR MILE 5c

FROM ANYWHERE TO EVERYWHERE

		PRICE	TIME
Stockton	to San Francisco	\$ 26.	1 hr. 05 min.
Modesto	" "	34.	1 hr. 25 min.
Oakdale	" "	36.	1 hr. 30 min.
Turlock	" "	38.	1 hr. 35 min.
Merced	" "	46.	1 hr. 55 min.
Fresno	" "	66.	2 hrs. 45 min.
Vinalia	" "	82.	3 hrs. 20 min.
Hanford	" "	74.	3 hrs. 05 min.
Tulare	" "	80.	3 hrs. 20 min.
Porterville	" "	90.	3 hrs. 45 min.
Maricopa	" "	102.	4 hrs. 15 min.
Bakersfield	" "	102.	4 hrs. 15 min.


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MINNEAPOLIS or ST. PAUL
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Valid if detached
Non-transferable

RETURN COUPON



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Airport or in the discretion of the pilot from the nearest available landing field.

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MINNEAPOLIS or ST. PAUL
(Curtiss N. W. Airport)

Valid if detached
Non-transferable

SCORE COUPON

course of nearly 600,000 miles of flight. Many of the trips were inter-city, made in response to the demand for speed which road, rail or water facilities were inadequate to meet.

Earl S. Daugherty, at Long Beach, Cal., has shown it to be possible to carry on transportation and exhibition work by defining and strictly separating them, with the result that safety and interest are combined.

In "The Birthplace of the Airplane," Dayton, O., the Dayton Wright Company and the Johnson Airplane and Supply Company are operating and training others to operate. In Chicago, the Diggins Aviation Company is training and operating, as occasion offers, to the various North Central cities. In Michigan, the Heddon Aviation Company, Inc., of Dowagiac, started advertising fishing tackle, then found that aerial advertising could be made to pay by operating.

In Kansas, where, in 1920, not a single operator was noted, there are now six. Of the operators, William Hill and the E. M. Laird Company, Arkansas City and Wichita, respectively, and the Longren Aircraft Corporation of Topeka, are notable. In the difficult mountain and lake region of Idaho, the Kelso Aviation Company of Lewiston is making aircraft popular.

Prominent in the service performed is the J. L. Aircraft Corporation of New York, which has operated for educational purposes approximately 100,000 miles across the nation, north and south and east and west, safely transporting in these many remarkable flights some 8000 persons.

In response to the traffic in congested New England, the Lynnway Aerial Transportation Company of Lynn reports the transportation of 10,000 passengers. The McGraw Aviation Company of Dallas and the Southern Aircraft Company of Houston are among the dozen companies operating in Texas, the vast distances and magnificent opportunities for general development in this great state making a particularly inviting field for aerial transport.

Missouri has an interesting problem, in that all the more important cities are on the border. The Robertson Aircraft Corporation, Inc., at St. Louis, is typical of the six in business in the state, this being an increase of five within a year.

Much of the aerial business around Los Angeles has been concentrated in the Rogers Airport, Inc., which is equipped with factory, seven hangars, etc., and reports the impressive passenger roll of 10,860 during the year.

In the "Inland Empire," the Foster Russell Aviation Company, Inc., of Spokane, Wash., performed an original and novel service.

One airplane, in a seven-months' "voyage," traversed 20,000 miles, visited 75 towns, carried 2000 passengers and advertised 30 Spokane industries. There was not even a forced landing. At their base, the company carried 575 additional passengers and conducted a training school.

Transportation and special service for the oil men and ranchers were supplied by the Southwest Airplane Company of Tulsa, Oklahoma. A somewhat similar problem in South Dakota, Western Minnesota and Northern Iowa is being met by Tennant Brothers at Sioux Falls.

Walter T. Varney of San Francisco is the outstanding figure in commercial aviation in Northern California. His base shelters fifteen machines. His operations extend down the coastal valleys to Los Angeles and over the Siskiyou to Portland. His airplane trips into Yosemite have been startling, following so closely upon the stage coach, regarded for years as the only practicable means of conveyance into the heart of the Sierra.

AERIAL PHOTOGRAPHY

Aerial photography has played such an important part in this year's commercial aeronautical activities that it should be classed along with passenger and freight carrying as one of the important outlets for the use of airplanes. Two New York concerns have specialized exclusively in aerial photography and have leased their planes from local aviation companies. These concerns are The Fairchild Aerial Camera Corp. and Hamilton Maxwell.

The uses to which aerial photographs have already been put are sufficient to indicate the breadth of the market. Factory photographs make up the largest single class of customers. The advertising value of aerial photographs is just beginning to be appreciated. Many of the more prominent advertising agencies have incorporated aerial illustrations in their clients' plans for the coming year.

The Consolidated Gas Company of New York used effectively a series of aerial photographs to prove before a state rate commission the necessity for buying additional real estate in order to provide sufficient working and storage space. A petition was recently presented to the Public Service Commission of New Jersey praying that the Pennsylvania Railroad be compelled to build a new station and stop all of its express trains at the indicated spot. The railroad company, by the use of aerial photographs, was able successfully to refute these claims by showing, as no other method could show, that the area was undeveloped and very thinly populated

and hence no station was required. Real estate brokers handling large industrial properties are beginning to realize the value of this new type of photography and will, within the next two or three years, be very profitable outlets for this branch of aeronautics. Other fields are rapidly opening up for the use of these views. The enterprising salesman will discover new outlets weekly.

All kinds of maps can be made economically and accurately by aerial photographic methods. These aerial photographic maps present a wealth of detail which is invaluable to anyone making a close study of any locality. The Fairchild Aerial Camera Corporation has made maps varying in scale from 1400 feet to the inch for large area maps to the 100 feet to the inch maps made for fire insurance purposes. One of the notable achievements of the year was the mapping of New York City in 69 minutes. Such detail was obtained that automobiles can be counted. This map is now being used by the City of New York, the Transit Commission of the State of New York, the New York Telephone Company, the Consolidated Gas Company, the New York Edison Company, the National City Company, the New York *Evening Journal*, the Russell Sage Foundation, the Corn Exchange Bank and many other prominent organizations in varied lines. This map was of such value that other cities soon followed New York, among them Newark, N. J.

For a large public service company the Fairchild Aerial Camera Corp. made a map to determine the best route for their high tension transmission lines. Property lines were put on this map and the names of the property owners. The Erie Railroad recently contracted for an aerial survey of their line from Port Jervis to Deposit.

In Canada, aerial photographic timber cruising was developed by Ellwood Wilson of the Laurentide Company, Ltd., to a point where it is now possible to estimate the cords per acre of any kind of timber from aerial photographs more accurately and economically than by the old method of sending men through the timber tracts at half mile intervals. Blown down areas and burned over areas are accurately measured.

FOUR WORLD'S RECORDS IN 1921

The increasing public interest in commercial aviation was evident in the demand for flying meets. Approximately a score of these were held in various parts of the country—notably New York, Clearwater, Fla.; Los Angeles and San Francisco, Cal.; Chicago, Kansas City,



Larsen J. L.-6, 185 h.p. B. M. W. engine, which made world's record for endurance of 26 hrs., 19 min., 35 sec.—Photo, International.



Loening monoplane "*Flying Yacht*," 400 h.p. Liberty engine, which made world record for altitude, with three passengers and pilot, 19,500 feet.

Omaha and other points in the Middle and Southwest—and were attended by many hundreds of thousands of persons.

It is significant of the trend to note that everywhere the requirement was for aircraft to demonstrate their utility and reliability as illustrated by speed, altitude, endurance, efficiency, etc. It is even more significant of the future that, in response to this challenge, American aircraft and American pilots during 1921 established four new world's records in the performances named.

On Aug. 16, David McCulloch, with three passengers, climbed to 19,500 feet in a Loening seaplane, equipped with a Liberty motor, at Port Washington, L. I., thus setting a new mark for marine flight efficiency.

Sept. 28, Lieutenant J. Macready, U. S. A. S., in an American designed and constructed biplane, Packard-Leperc, Liberty motored, ascended to 35,563 feet, practically six and one-half miles, at Dayton, Ohio.

Nov. 3, Bert Acosta, in a Curtiss-Navy racer, powered with a Curtiss C-12 motor, set a new world's record for speed on a closed circuit, at the Pulitzer race in Omaha, flying at the rate of 174.77 miles an hour.

And finally, on Dec. 30, Eddie Stinson and Lloyd Bertaud, in a J. L.-6 (Larsen monoplane), remained aloft at Roosevelt Field, L. I., for 26 hours, 19 minutes and 35 seconds.

A RAILROAD MAN'S VIEWS

During 1921 certain definite and very encouraging expressions regarding the practical application of aircraft to transportation were made by individuals in responsible positions.

As has been stated, "Commerce Calls for Speed; Flying is the Answer." If the hopes of aviation are fulfilled, there must be first of all a response among the traveling public. Thousands have flown out of curiosity; many are now flying for pleasure; some are flying out of preference and for purely business reasons. Will the time come—and how soon—when families will book passage over continents and seas as simply as they now travel by train and steamer?

Mr. Felton, the railway executive referred to a few pages back, in an article in *Collier's Weekly*, Nov. 19, 1921, entitled "Less Waste More Speed," observed:

"During the war I had seen planes by the thousand. I know how wonderfully useful they were. They were just as much a part of the army as the cannon and the rifles and the trench helmets. But those planes were tremendously expensive, and we did not expect them to be safe. . . . But never until

I got into Europe (in 1921) did I realize that traveling by air was not on a par with communicating with Mars, but that it was here—and here in such shape that it must enter into the calculation of railway men everywhere.”

Mr. Felton was particularly interested in the perplexing situation in which the railways now find themselves due to the demand for high speed, whereas the profit in railroad operation comes from the slow freight and not the express or limited passenger trains. This was clearly brought out in an article in the Aug. 6th issue of *Railway Age*, by George R. Henderson, in which it was stated:

“Speed increases the cost of hauling in a very striking manner, principally as the train load must be greatly reduced if we wish to haul at high speeds. . . . Passenger traffic is even more expensive. The 18-hour trains between New York and Chicago were so notoriously costly to operate that for several years they have been abandoned. It has been demonstrated that a speed of about 15 miles per hour is the most economical for ordinary freight trains.”

Enter the airship, with huge capacity and economical speed of greater than 60 miles an hour.

Enter the airplane, with ample capacity for traffic (passenger and freight) requiring extra fast service, with an average economical speed of from 90 to 125 miles an hour!

Mr. Felton, with full knowledge of the railroad's needs and the capabilities of other means of transport, such as aircraft and the motor truck, comments thus:

“But the real point of interest to me is not that airplanes can safely carry passengers or that motor trucks can handle short hauls cheaper than can the railways, but the influence that airplane travel is going to have upon business and social development and the change that the motor truck will make in transportation. Those who are old enough will remember that when the long-distance telephone came into general use it was thought that it would cut down fast passenger travel. For a time it did, but then it stimulated fast travel and, as much as anything, forced on the fast trains. The telephone developed business—the late George W. Perkins always held that it was the telephone and telegraph that made possible the big corporations. What great change in business will air travel effect in America? What will it do for Europe?

“And then there is another phase; the fast passenger train has made necessary heavy rails and ballasting; these have greatly increased the cost per mile of the most expensive part of a railway—the roadbed. The fine roadbeds which we have are not necessary for freight trains. And the roadbed, although the biggest investment, is the least used part of a railway—which increases the tariff rates. Again, our roads lose money on the short hauls; they make their money on long hauls of slow-moving freight. Will the airplane and the motor truck serve to help solve the railway problem of the future by cutting out the fast passenger trains, the short-haul freight trains and the expensive passenger terminals? There is a good deal to think about.”

The inescapable conclusion is that the railroads will find in aircraft, not a hostile competitor fighting for the same traffic, but a friendly and welcome auxiliary which will relieve the oppressed rail lines of the speed-burden that is rapidly becoming unbearable. The pioneers in aircraft would seem justified in the conviction that not only will high-speed traffic flow to aerial operators, but that the great land and sea carriers will facilitate its transfer.

PROSPECT FOR EXPRESS BUSINESS

The American Railway Express Company seems to take such an attitude. Robert E. M. Cowie, vice-president, has studied the advantages of aircraft. To the Aeronautical Chamber of Commerce he has stated:

"The American Railway Express Company is very deeply interested in the subject of aerial transportation and is desirous of considering the question of a contract for the handling of express matter with any responsible aerial transportation company whenever such a company is launched and has demonstrated its ability to furnish a reliable service, provided, of course, that it is possible to arrive at a mutually satisfactory agreement with respect to the compensation paid for such a service."

Intimately connected with passenger and express transport is the carriage of the mails. The mails always have gone and always will go by the fastest available means. It is not the conception of the mail service to choose the cheapest but the quickest delivery. The Air Mail has already demonstrated its utility, and is certain to increase in volume of traffic until it is finally taken over by private operators.

CREDIT AND THE RELEASE OF CREDIT

Finally, we have to consider a most dominant element in modern business, in the successful functioning of which aircraft are about to take a peculiarly important part. This is banking. The financial powers of the nation are notably unwilling to take cognizance of, much less interest themselves in, new commercial activities until such activities have demonstrated security and utility. This was true in the early days of the automotive industry; it has been true, until recently, of aircraft.

The modern banker believes in conserving time. It is the genius of his business. Anything from a labor-saving device for his counting room to scientific research affecting investments, present or future, enlists his interest. And it has been the good fortune of aircraft to make both a practical and personal appeal.

The executive of a bank, traveling on business, represents a liability or an asset according to the dispatch with which he travels. He cannot afford to go to Chicago or San Francisco by a slow train, or to Europe by a slow boat. He must go by the fastest. And as the times change, these means of travel, too, must improve. Hence, as the first few commercial aerial transport lines make their appearance here and abroad, there are signs that these executives recognize what is offered and what it means. Thus W. Irving Bullard, vice-president of the Merchants National Bank of Boston, made literally a "flying" trip through Europe, by utilizing aircraft for a thousand miles or more on stages of his itinerary which, by train or motor, would have required the expenditure of time almost beyond his command. Thus also we find a party of New York bankers and capitalists, including Charles E. Mitchell, president of the National City Company, and Howard Page, formerly of Standard Oil, chartering an Aeromarine cruiser for the flight to Cuba.

Confidence is a matter of acquaintance. The National Bank of Commerce of New York assigned a member of its staff, Kenneth S. Gaston, to investigate the commercial aviation situation. Mr. Gaston's observations were published in the bank organ *Commerce Monthly*, for November, 1921.

"Aviation as a factor of increased importance in commercial transportation," he writes, "is one of the fortunate legacies of the great war. . . . In 1914 the commercial possibilities of aviation seemed so remote that they were given little attention. In the seven years since that time, however, development has been so rapid that commercial air transportation is today a matter of general interest and substantial importance."

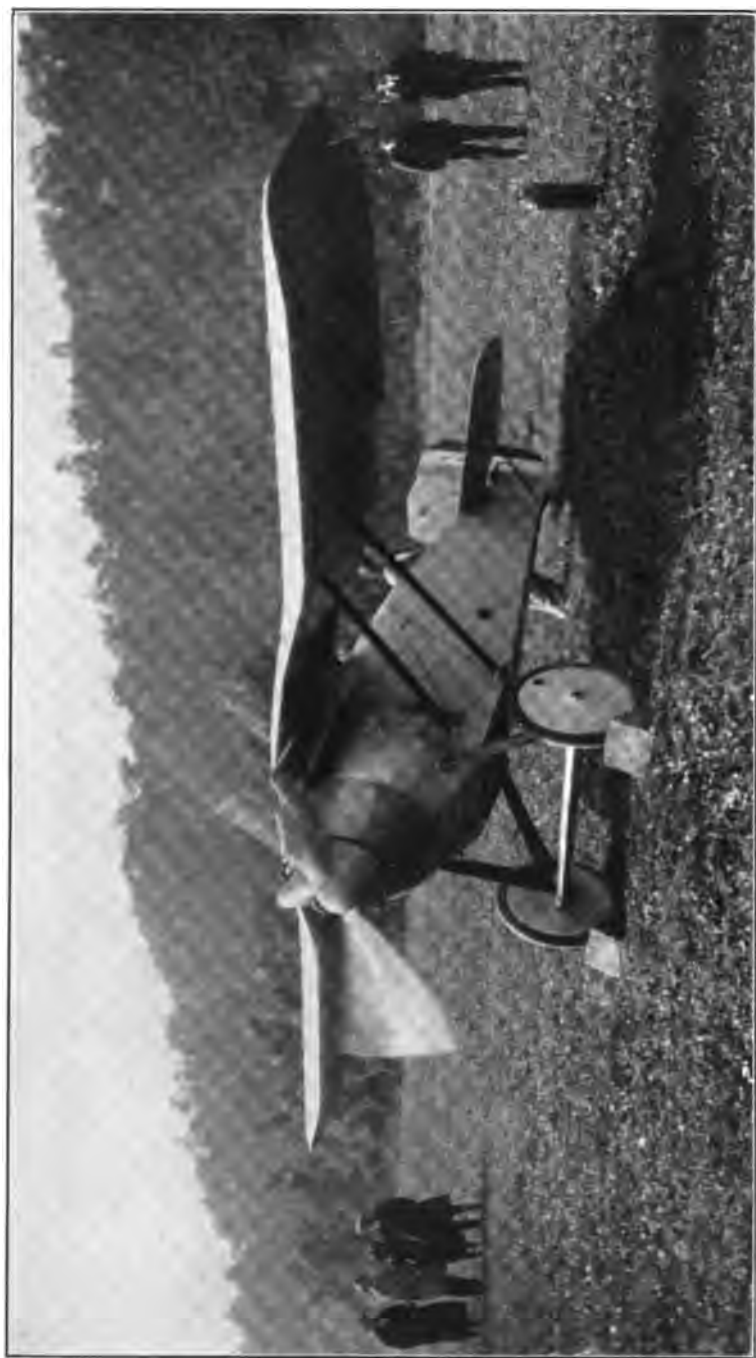
Encouraged by the interest manifested, the Aeronautical Chamber of Commerce sought to ascertain what service aerial transportation could offer to the banking institutions and how valuable this service would be.

In answer to an inquiry, a banker said: "As banking deals almost entirely with interest payments in one form or another and as interest payments depend necessarily upon the time element, it is obvious that time is an extremely important factor. The time of transit of interest-bearing paper is important because of the fact that during this time the paper (or rather the capital that it represents) is unavailable and hence unproductive."

The establishment of a central gold fund and the practice of daily clearances by telegraph, made possible by the Federal Reserve System, worked a constructive change in our banking methods. Hitherto a check, in order to "clear" (and the capital be thereby released) had



Lieut. J. Macready, U. S. Air Service, and Packard-Lepere, in which he made world's altitude record of 37,800 feet, corrected.—Photo, U. S. Air Service.



Thomas-Morse M. B.-7 type of fighting monoplane, 400 h.p. Wright H.-3 engine. Developed for air service and contender in 1922 Pulitzer race.

to be transported to the point of delivery and back to the point of origin. Taking New York as typical, prior to the creation of the Federal Reserve machinery it required four days for clearances between Chicago, Minneapolis and Jacksonville, whereas it now takes but two; it required six days to New Orleans, Kansas City and Dallas, and now but three; it required eight days to Denver, Spokane and Seattle, and now but four; it required ten days to San Francisco and Los Angeles, and now requires but five.

It is estimated that at least \$1,000,000,000 in capital is in transit daily in the form of checks. To reduce the clearance time one-half, as was accomplished by the Federal Reserve System, meant a daily release of 50% of this "float" or \$500,000,000, which, even in so big a country as ours, is a huge sum.

The problem now is to make further saving, to tolerate less waste of credit and achieve more speed in clearance. The existing system is predicated upon the fastest surface transportation. It is apparent that there can be no great change until the means of conveyance are improved.

Here enters the aircraft operator. Airplanes have actually spanned the continent in *thirty-three* hours, and with night flying can do it in *less*. They can today cut down one-half to two-thirds the fastest rail schedules in the country—especially between the great banking centers. When this was pointed out to a banker, he exclaimed, "Why, aircraft will repeat what the Federal Reserve accomplished. By halving the time of transporting checks you will halve the 'float'—you will release daily a quarter to a half billion dollars which is now unavailable and unproductive while in transit!"

That is what speeding up by air means to banking and business!

TABLE

<i>Name of Company</i>	<i>Address</i>	<i>Air Port Facilities</i>	<i>Shop and Repair Facilities</i>	<i>Equipment</i>
Adams Aircraft Co.	Oklahoma City, Okla.	Field (leased), 80 acres; hangar 50 x 75	Limited	2 L.S. (W. 150 h.p.)
Aeromarine Airways, Inc.	Times Bldg., New York, N. Y.	Terminals, Keyport, N. J., New York, N. Y., Atlantic City, Key West, Havana, Palm Beach, Miami, Bimini, Nassau, Tampa, St. Petersburg, Belleair Heights, Fla.	Excellent Keyport, N. J., Key West, Fla.	8 A.-Navy 11-pass. Flying Cruisers 17 A.-Navy H. S. 5-pass. Flying Boats 5 A. 30-place Flying Boats
Miles City Aero Club, Inc.	Miles City, Mont.	Use Government Reservation; 3000 x 4500, L shape	Use repair shop in town	1 J.-1 (OXX2) 1 J.N.-4-D. (OX5)
American Airways	College Point, N. Y.	Field (leased); hangar 65 x 100, two floors	Complete for any airplane job	1 H.S.-1 Flying Boat (L. 400 h.p.)
Ashmuseen Aeronautical Co.	65th and Center Sts., Omaha, Neb.	Field (municipal), 40 acres; hangar 80 x 100	First class; all types aircraft	1 <i>Blue Bird</i> (5 pass. 300 h.p. Sal.) 1 U.E. Plane (150 h.p.) 1 J.N.-4-D. (OX5) 1 J.N.-4-C. (OX5) 1 J.N.-4-D. (OX5)
Aurora Aviation Co, Inc.	Aurora, Ill.	Field (leased) 66 acres; hangar	Minor repairs	1 S.J.-1. (OX5)
B. B. & B. Aerial Co.	Marshfield, Wis.	Field (leased), 19 acres	None	1 J.N.-4-D. (OX5) 1 Can. J.N. (OX5) 1 J.N.-4-C. (OX5) 2 <i>Swallows</i> . (OX5)
Beaty Aviation Co.	Dallas, Texas	Field (leased), 50 acres; hangar 30 x 50	Fair	
Nimmo Black Airport, Inc.	Chicago, Ill.	Field (leased), 40 acres; hangar 68 x 75	Good	
Bowen & Huston	Windsor, Mo.	Field (leased), 35 acres; hangar	Ordinary	1 J.N. (W. 150 h.p.)
Central Aircraft Co.	Holdrege, Neb.	Field (leased), 40 acres; hangar 32 x 60	Have both	1 Can. J.N. (OX5) 1 <i>Lark</i> Monoplane (Law. 60 h.p.) 1 S.J.-1. (OX5) 1 J.N.-4-D. (OX5)
Chadwick Bros.	150 Broad St., Newark, N. J.	Brainerd Field, Hartford, Conn. (owned by city), 90 acres		2 J.N.-4-D. (OX5)
C. E. Cheney Aero Co.	Greene, Ia.			
Cleveland Air Service	Coventry, Vt.	Field (owned), 800 x 1700; one-ship hangar	Workshop in hangar; garage $\frac{1}{2}$ mile	1 J.N.-4-D. (OX5) 1 S.J.-1. (C.-6)
Vincent J. Burnelli	Amityville, N. Y.	Field Curtiss (leased) at Copague, L. I.	Complete factory at Amityville	R. B. <i>Airliner</i> (30-pass. biplane) (L. 2400 h.p.)
Commercial Airship Syndicate	Kansas City, Kan.	Field (leased), 36 acres; hangar 40 x 120	General shops	<i>Pony Blimp</i> (gasoline capacity 35,800 cu. ft.)
Concord Aircraft Co.	Concord, N. H.	Field (State Mobilization) 1 mile long, $\frac{3}{4}$ mile wide; hangar (4 barracks)	State Highway Repair Shop	1 S.J.-1 (W. 150 h.p.) 1 S.J.-1 (OX5)
Cooke Aero Co.	Watertown, S. Dak.	Field (part owned and part leased), 40 acres, western edge of town; hangar 50 x 54	Shop	1 504-K (3-place, LeR.) 1 S.J.-1 (H.S.)
Harry Depew Copland	Cambridge, Mass.	Seaplane Base (leased) Hartford, Conn., Indian Neck, Conn., Daytona Beach, Fla.		1 A.-39-B. (OXX6)
Robert H. Craig, Jr.	589 Arcade Bldg., St. Louis, Mo.	Field (municipal); Aerial Mail Hangar		1 <i>Oriole</i> (K.-6)

NO. I

Total No. Flights	Average Duration of Flights	Total Mileage	Passengers Carried	Lbs. of Freight	Charge per Short Flight	Charge per lb. of Freight	Operating Territory	Charge per Mile Inter-city Flights
1,000	30 min.	45,000	1,750	0	\$10.00 to 15.00		Oklahoma City, Ardmore, Tulsa, Okla., Dallas, Tex., etc.	\$.75 (Minimum within 300 miles \$25.00)
		95,020	6,914	24,002	5.00		N. Y.-Atlantic City and intermediate points; N. Y.-Havana; Key West-Havana; Miami, Palm Beach, Nassau, Bimini, Tampa, Belleair Heights, St. Petersburg and Key West; Great Lakes region; N. Y.-Albany; Lakes George and Champlain-N. Y. and New England Coast	.33 $\frac{1}{2}$
3,000	25 min.	85,000	1,000	0	10.00			
200	15 min.	4,000	600	0	.75 to 1.00 per min.			
1,000	30 min.	40,000	2,500	very little	5.00	\$.12 $\frac{1}{2}$ per 100	No established routes	.20
500	15 min.	8,500	400	0	10.00			
		12,000	400		.75 per min.			
1,200	20 min.	12,000	800	0	5.00	.50	All points in Texas	.35
2,000	10 min.	18,000	3,500	0	10.00		St. Louis, Des Moines, South Haven, Columbus, Ohio, etc.	1.00 one way .60 round trip
150	20 min.	3,000	75	very little	10.00		Neighboring towns and Kansas City	
1,400	15 min.	24,500	432		10.00		Kearney, Minden, Oxford, Lincoln	.50
1,100	20 min.	25,000	500		10.00			.75
800	20 min.	16,000	750		7.50 and 10.00		North Central	20.00 hr.
125 Sept. 1, 1921 to Oct. 21, 1921	15 min. to 3 $\frac{1}{2}$ hrs.	1,000	78	0	10.00		Burlington, Vt. Newport, Vt., Concord, N. H., Boston, Mass.	40.00 per hr. .60 per mile
114	50 min.	8,000	550	0	Experimental			
27	50 miles	1,200	21	350	10.00	.50		
700	15 min.	22,000	1,000		10.00		All over New England	\$1.00 one way 1.50 round trip 50.00 per hour (average)
					10.00		Anywhere	
400	15 min.	6,000	500	200 (Maine to Florida)	10.00 to 25.00		Portland, Me., Boston, Springfield, Hartford, N. Y. C., Philadelphia, Washington, Richmond, Raleigh, Charleston, Savannah, Jacksonville, Daytona	.75
200	10 min.	2,900	250		10.00		Anywhere on demand	.50

TABLE NO.

<i>Name of Company</i>	<i>Address</i>	<i>Air Port Facilities</i>	<i>Shop and Repair Facilities</i>	<i>Equipment</i>
Curtiss Aeroplane and Motor Corp. Curtiss Aeroplane and Motor Corp.	Buffalo, N. Y. (Kenilworth Field) Garden City, N. Y.	Field (leased), 2000 x 800; 2 hangars Field (owned) $\frac{1}{4}$ mile square; 14 hangars	Complete Complete	1 S.J.-1 (C-6) 1 J.N. (OX) 10-20 J.N.-1 (OX) 5 Orioles (C-6) 2 Orioles (OX) 5 S.J.-1 (C-6) 1 D.-Pusher 2 Navy Racers 1 C.T. 2 Oremcos Large stock of completed J.N.-4-D. and J.N.-4-C. (OXs)
Curtiss Aircraft Corp.	Dallas, Tex. (Love Field)	Field (leased by government) regulation gov. flying school; 2 hangars	Complete	4 J.N.-4-D. 1 S.J.-1 (K.-6)
Curtiss Eastern Airplane Corp. Curtiss-Indiana Co.	130 So. 15th St., Philadelphia, Pa. Kokomo, Ind.	Field (leased), 100 acres; 2 hangars, 50 x 75 Field (leased) $\frac{1}{4}$ mile square; 3 hangars: 1-48 x 100; 2-66 x 100	Complete Excellent	27 planes, including Orioles (C.-6, K.-6, OX) S.J.-1, J.N.-4-D., Can. J.N. and Br. Bomber 1 H.-16 Flying Boat (W.) 2 Seagulls 1 F Boat 1 H. S.
Curtiss-Metropolitan Airplane Co.	505 Fifth Ave., New York, N. Y.	Terminals (Port Washington, L. I., N. Y. and Palm Beach, Fla.) for flying boats; one at each terminal	Service at each	Large stock of completed Orioles (K.-6 and C.-6) S.J.-1 (K.-6 and OX) J.N.-4-D. Can. J.N.
Curtiss Northwest Airplane Co.	707 Metropolitan Bank Bldg., Minneapolis, Minn.	Field (leased) $\frac{1}{4}$ mile East and West, $\frac{1}{4}$ mile North and South; hangar 65 x 70	Fuselage and wing repair shop motor repair shop motor test stand	1 An. A.-300-C, six-place (Fiat) 7 J.N.-4 (OXs) 2 S.J.-1 (OXs) 5 Orioles (K.-6)
Curtiss Iowa Aircraft Corp.	Fort Dodge, Ia.	Fields, 65 acres each, Ft. Dodge (owned), Des Moines (leased), Oelwein (leased), Fairfield (leased); Monmouth (leased); hangar for 6 planes at Fort Dodge, for 2 planes at other fields	Repair shop at each field	1 S.V.A. single-seater (SPA, 220 h.p.) 1 S.J.-1, three-seater (C.-6, 160 h.p.) 1 Can. J.N. (OXs, 90 h.p.) 1 S.J.-1, two-seater (OXs, 90 h.p.) 1 Can. J.N. (OXs) 2 J.N.-4-D. (OXs) 1 D. Special (OXs) 1 P. Special (OXs) 1 N. 28 (Gn. 160 h.p.) 1 L.H. 4-H. Seaplane (H.S. A.-5-A. Touring 175 h.p.) (OXX3, 110 h.p.) 1 K.T. (L.-12) 1 O.W. (W. 150 h.p.) 1 S.J.-1 (H.S.L.-6) 4 Can. J.N. (OXX and OXXs) 1 J.N. (twin OXX)
Curtiss Wisconsin Airplane Co.	330 Clinton St., Milwaukee, Wis.	Field (leased) 100 acres; hangar 50 x 50	Good	
Earl S. Daugherty School of Aviation	Long Beach, Cal.	Field (owned) L shape, 1400 x 400 and 1350 x 270; 2 hangars, capacity 11 ships	Good	
Wm. R. Davis, Jr.	Oakland, Cal.	Field on property of Alaska Packers Assn., Alameda; hangar 76 x 35	Tools and accessories	
Dayton Wright Co.	Dayton, O.	Field (leased) 151 acres; hangar space in main plant		
DeLuxe Air Service, Inc.	Asbury Park, N. J.	Fields, Deal, N. J. (800 x 1800) and Como, N. J. (1800 x 1500); hangar at Deal 160 x 35; tent at Como	At Deal	
The Ralph C. Diggins Co.	140 No. Dearborn St., Chicago, Ill.	Field (leased) 1 square mile; 3 hangars, 65 x 40 x 15	Excellent	
Edgewater Beach Air Service	3158 N. Clark Street, Chicago, Ill.	Terminal Edgewater Beach Hotel (leased); hangar 54 x 30	Machine shop and mechanic	

I — Continued

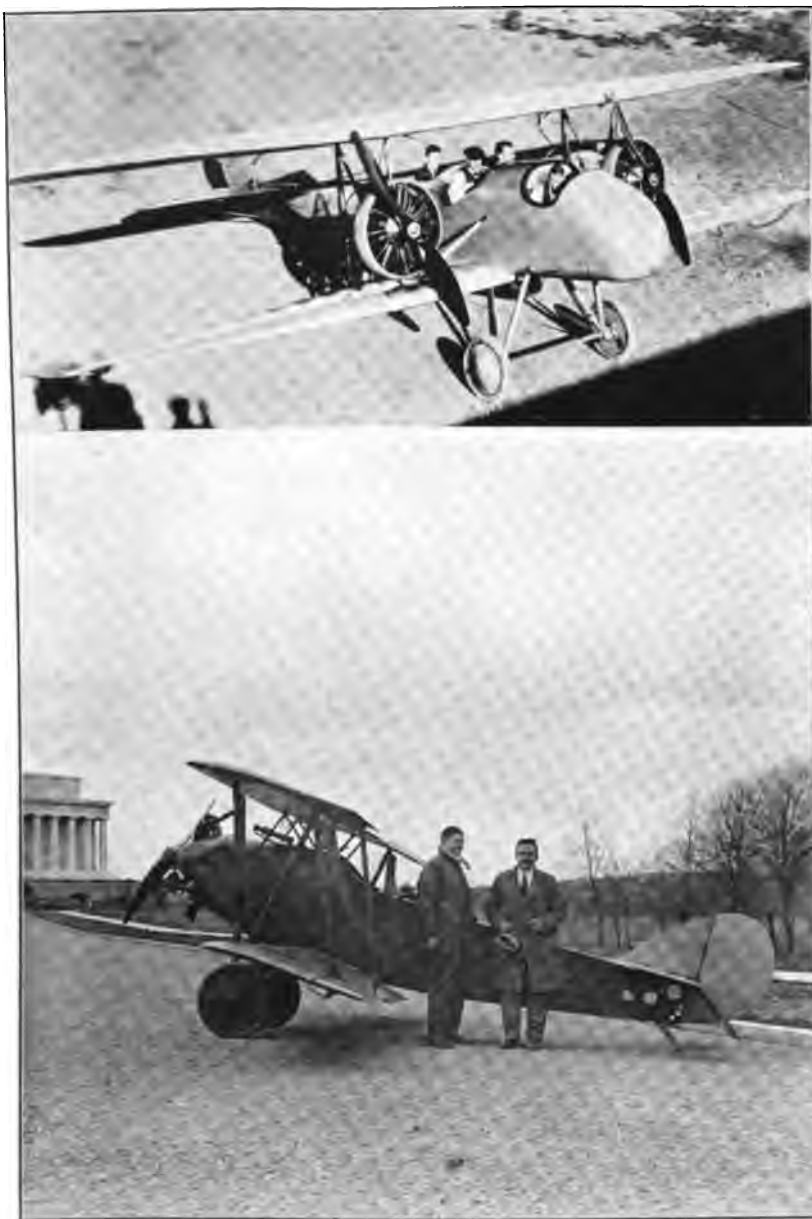
<i>Total No. Flights</i>	<i>Average Duration of Flights</i>	<i>Total Mileage</i>	<i>Passengers Carried</i>	<i>Lbs. of Freight</i>	<i>Charge per Short Flight</i>	<i>Charge per lb. of Freight</i>	<i>Operating Territory</i>	<i>Charge per mile Inter-city Flights</i>
800	15 min.	15,000	200		\$10.00		Anywhere desired	\$.80-1 pas.
2,000	15 min.	50,000	500		10.00		Anywhere desired	1.00-2 pas. 1.80-1 pas. 1.00-2 pas.
50 (test and demonstration) 1,200	30 min.	2,500	40	0			Local	
	12 min.	60,000	829	0	10.00			.75
10,000	15 min.	300,000	10,000	0	10.00 and 15.00	\$.50	Indianapolis, Chicago, Dayton and Rantoul	.50
1,000	10 min.	25,000	5,000		10.00		New York, Lake George, New London, Southampton, Newport, Atlantic City, Miami, Havana	.50
1,500	15 min.	40,000	1,700	very little	10.00	.03 1/4	Chicago, Twin Cities, Fargo, LaCrosse, Duluth, Sioux Falls, Aberdeen	.50
6,000	15 min.	90,000	4,500		5.00 to 10.00	.15 cross country	Between own fields	.15
2,000	20 min.	40,000	500		5.00			.50
1,978	15 min.	27,400	3,220	0	5.00 and 10.00		Long Beach to Los Angeles, Venice, Ventura, San Diego, Pasadena, Riverside	50.00 per hour
62	30 min.	2,000	20	0	10.00		Oakland, San Francisco, Berkeley, Alameda, Sausalito, Richmond, etc.	
800	30 min.	32,450	963				Detroit, Cleveland, Indianapolis, Toledo; (occasionally N. Y. City)	
400	10 min.	6,000	400	200	10.00		New York-Atlantic City	.50
10,000	4-5 min.	60,000	2,000	very little	10.00		Chicago and all Middle Western cities	.25
250	20 min.	50,000	300	newspapers	15.00-1 25.00-2		Chicago-Evanston; Milwaukee, Waukegan, Benton Harbor and all points on lake	1.00

TABLE NO.

<i>Name of Company</i>	<i>Address</i>	<i>Air Port Facilities</i>	<i>Shop and Repair Facilities</i>	<i>Equipment</i>
G. Elias & Bro., Inc.	Buffalo, N. Y.	Field foot of Jersey Street, 50 x 200; 2 hangars, 40 x 50	Complete	
F. W. Farris	Stockton, Cal.	Field, Stockton Aviation Center (leased), 64 acres; hangar 50 x 35	Repair facilities	1 J.N.-4 (OX5)
Finger Lakes Air Service, Inc.	Auburn, N.Y.	Terminal Owasco Lake, Auburn, N. Y.		1 Navy H.S.2-L. (6 pass.)
Flying U School of Aviation	San Antonio, Tex.	Field (leased) speedway 2000 acres, Stenson Field 1000 acres; 4 hangars, 40 x 150 and 30 x 70	Machine shop and assembling plant	7 J.N.-4-D. 1 S.J.-1 1 T.M. 1 Camel (OX5, H.S., Cl., LeR., L. 12) 1 S.J.-1 (OXC6)
Oliver Gies Airplane Co.	Great Falls, Mont.	Field (leased) $\frac{1}{4}$ x $\frac{1}{4}$ mile; hangar 40 x 55		
Good & Foster Aerial Service	Love Field, Dallas, Tex.	Love Field (leased); govt. hangar	General airplane repair	2 J.N.-4-C. (OX5)
Grand Island Aero Co.	Grand Island, Neb.	Field (leased) 2700 x 500; 3 hangars: 2 Tents, 1-40 x 90	Repairing at field	4 J.N.-4-D. 2 Orioles
Great Lakes Airways Co., Inc.	Cleveland, O.	Terminals Put-In-Bay, Cleveland and Detroit; inside harbor at Cleveland (permission of city) 6 miles x 1 mile; hangar for one ship at Put-In-Bay	Excellent for boat repair; fair for motors	1 A.-H.S.-2-L Cabin Cruiser (L. 330 h.p.)
Gulf States Aircraft Co.	Shreveport, La.	Uses Fair Grounds		2 S.J.-1, 3 pass. (OX5)
Dillard Hamilton	West End Viaduct, Dallas, Tex.	Field (leased) 108 acres	5 mechanics 1 pilot Good repair shop	1 Can. J.N. (OX5)
A. W. Hansen Heddon Aviation Co., Inc.	Rio Vista, Cal. Dowagiac, Mich.	Field (leased) 40 acres; hangar 44 x 56	Good	1 L.S. (W.) 2 Can. J.N.-4-C. (OX5) 1 Swallow 1 S.J.-1 (OX5)
Henderson-Maukin Aero Service Co.	Fulton, Mo.	Field (leased) 2000 x 2600; hangar 60 x 90	Good	2 J.N.-4-D. (OX5)
William Hill Airplane Co.	Arkansas City, Kan.	Field (leased) 90 acres; 1 mile north of city	oil and gas on field; Hill Garage, city	1 J.N.-4-D. 1 S.J.-1
Hodgen Aerial Service Cliff Hogan Aviation, Auto and Tractor School	Enid, Okla. 2623 McGee Trafficway, Kansas City, Mo.	Hangar for 2 ships	Repair shop	2 S.J.-1 (OX5) 1 Can. J.N. (3 engines)
E. Hubbard	56 Roanoke St., Seattle, Wash.	Terminals (leased) Seattle, Wash. and Victoria, B. C.-Lake Union, Seattle, 2 x $\frac{1}{4}$ mile, Victoria Harbor $\frac{1}{4}$ x $\frac{1}{4}$ mile; hangar 220 x 100	Repair service from Boeing Airplane Co., Seattle, Wash.	1 B.-1 Flying Boat 1 C.L.-4-S. Seaplane
Fred W. Hungate	Pomeroy, Wash.	Field (owned); government hangar		1 J.N.-4
Huron Aerial Rapid Transit Co.	Huron, S. D.	Field (leased); hangar	Shop	1 J.N.-4 (OX5)
Johnson Airplane and Supply Co.	Dayton, O.	Field (leased) 1500 x 2200; hangar 120 x 80	6 buildings, supply station for aircraft material and all leading accessories	1 J.N.-4-D. (OX) 1 J.N.-4-H. (W.) 1 F.E.-2-B. (Bd. 160 hp) 1 L.V.G. (Bn. 220 h.p.) 1 Can. J.N. (OX5)
W. Wallace Kellett	717 Widener Bldg., Philadelphia, Pa.	Field (leased); hangar		F-40 Pushers 3 Sport F., 2 seaters



Laird *Swallow*, 90 h.p. OX₅ engine, two passengers, pilot and baggage.
Below—Longren Commercial, 60 h.p. Anzani engine.



Elias Commercial, two 80 h.p. LeRhone engines; accommodating four passengers and pilot. Below—Sperry "*Sport Messenger*," 60 h.p. Lawrance engine.

I—Continued

Total No. Flights	Average Duration of Flights	Total Mileage	Passengers Carried	Lbs. of Freight	Charge per Short Flight	Charge per lb. of Freight	Operating Territory	Charge per Mile Inter-city Flights
25 (test)	30 min.	3,000	0	0				
753	10-15 min.	15,000	430	0	\$ 10.00 up		Stockton, Fresno, Modesto, San Francisco, Sacramento; any town in San Joaquin Valley	\$.75
150	15 min.	4,500	450	0	10.00		Owasso, Skaneateles, Cayuga and Seneca Lakes, and Thousand Islands	
400	25 min.	12,000	150	1,000	10.00		Corpus Christi, Dallas, and San Antonio	.50
100	20 min.	3,000	60		10.00		Great Falls, Helena, Mont.	50.00 per flying hour
150	varied	4,000	50	100		\$.75	Dallas, Tulsa, Ardmore, Okla. City and Breckenridge, Tex.	.75
	10-15 min.	20,000	500		7.50 to 15.00			.50
100	20 min.	1,200	100	200	10.00 to 15.00	.30	Cleveland, Detroit, Put-In-Bay, Erie, Sandusky, Toledo	.50 to .75
1,000	10 min.	25,000	1,000		5.00 to 10.00		Southern States	.25 each way
50 hrs.	2 hrs.	3,500	few		5.00	1.00 per mile	Texas	1.00
1,069	varied (cross country)	22,000	1,013	500	10.00 up	by contract	Northern Indiana, Southern Michigan	.75 to 1.00
1,500	20 min.	30,000	700	0	5.00		Missouri, Kansas, Illinois, Texas and Oklahoma	.50
2,000	10 min. to 2 hrs.	40,000	1,500		7.50-15.00-2		Kansas, Oklahoma, Texas	.50
1,000 few	15 min.	17,000	800		7.50		Enid, Oklahoma City	.50
200	2 hrs.	20,000	100	50,000 U. S. Mail	10.00	.003	Seattle, Wash., and Victoria, B. C.	
10	15 min.	900	20		10.00		Pomeroy and Spokane, Wash.	.50 one way .75 two ways
	10-12 min.	20,000	500	0	10.00		South Dakota, parts Nebraska, Minnesota, North Dakota	.33 1/4; 25.00 minimum
500 started May 1st, 1921	30 min.	20,000	100	3,000	10.00		Dayton, Columbus, Cincinnati, Kokomo, Piqua, all parts of Ohio, Indiana and West Virginia	1.00
300 (demonstration)	20 min.	7,500	150	0				

TABLE NO.

<i>Name of Company</i>	<i>Address</i>	<i>Air Port Facilities</i>	<i>Shop and Repair Facilities</i>	<i>Equipment</i>
Kelso Aviation Co.	Lewiston, Ida.	Field (leased) 600 x 1800; hangar 50 x 60		1 J.N.-4 (OX5) 1 S.J.N.-1 (OX5) 1 L.S. (W. 150 h.p.) Small seaplane (own manufacture) (Le R. 80 h.p.)
Killapa Harbor Aero Mfg. Co.	Hoquiam, Wash.			1 J.N.-4-C.
C. G. Killingsworth	116 W. 9th St., Dallas, Tex.	Field Viaduct Aviation Field (leased), 200 acres	Garage	
E. M. Laird Co.	Wichita, Kan.	Field (owned) N.E. of town, 1300 ft. square, 4 hangars 40 x 50	Factory building 66 x 140	Swallows (OX5)
Lambert Flyers	Ellenboro, W. Va.	Fields at Lambertson, W. Va., and El Dorado, Ark., 40 acres sq.; hangars 90 x 100, 40 x 100 respectively	Good	6 S.J.-1 (K.-6 and C.-6) 1 Oriole
John M. Larsen	347 Madison Ave., New York City	Field Central Park, L. I., N. Y., 1000 x 2600; 3 hangars, 10,000 sq. ft. area	Complete manufacturing facilities	6-8 J.L.-6 All Metal Monoplanes (BMW, 185 h.p.) 1 J.L.-12 (L.)
L. W. Leib	Volga, S. D.	Field (leased) 720 x 1000; hangar	Good	1 S.J.-1 (OX5)
James Levy Aircraft Co.	Indiana Ave. at 21st St., Chicago, Ill.	Field Aero Club of Illinois		Can. J.N.'s 514-K's, 3-seater
Lexington Aviation Co., Inc.	Lexington, Ky.	Field (leased) 900 x 2100	In town	1 504-K., 3-seater
Lirette's Flying Circus	Dallas, Tex.			1 J.N.-4
Floyd J. Logan Aviation Co.	Cleveland, O.	Field (leased) 70 acres; hangar	Good	2 Can. J.N. (OX5) 2 S.J.-1 (OX5)
Longren Aircraft Corp.	Topeka, Kan.	Field (leased) $\frac{1}{2}$ x $\frac{3}{4}$ mile, adjacent to factory; hangar	Complete factory	1 L.H. (OX5) 1 L.A.K. (Law. 3 cyl.) 3 L.A.K. (An. 6 cyl.)
Lowell Aircraft Corp.	Oberlin, O.	Field (leased), 200 x 900; hangar 45 x 50	Very good for motor accessory	1 J.N.-4-D. (OX5) 1 S.J.-1 (OX5) 1 Can. J.N. (OX5)
Lutz Manor Co.	Oshkosh, Wis.	Field (leased) at city limits, 80 acres, rectangular, good approach; hangar 45 x 65, for 3 planes	Good	1 J.N.-4-D. (OX5 and OXX6) 1 Ballila Racer A-1 (SPA, 225 h.p.)
Lynchburg Air Service Corp.	Lynchburg, Va.	Field (leased)	Shop, warehouse, 2 mechanics	1 S.J.-1
Lynnway Aerial Transportation Co.	Lynn, Mass.	Field (leased) 1000 x 1500; 2 individual hangars	Good	2 Can. J.N. (OX5) 2 S.J.-1 (OX5) 1 Can. J.N. (OXX6) 1 S.J.-1 (C.-6) 1 S.J.-1 (Mer. 160 h.p.)
McGraw Aviation Co.	116 W. 9th St., Dallas, Tex.	Field (leased) 108 acres	Shop 40 x 30 and shed	3 J.M.-4-D. 9 J.N.-4-C.
R. W. Mackie	Houston, Tex.	Field (small), hangar (rented)	Repairs handled	1 S.J.-1 (W. 180 h.p.) 1 S.J.-1 (W. 150 h.p.) 1 S.J.-1 (OX5)
Massachusetts Aircraft Corp.	Delano Ave., Point of Pines, Mass.	Field Saugus Race Track (1 mile track); hangar for 3 ships	Motor room	1 B. Bullet Monoplane (Le R. 120 h.p.) 1 504-K (Le R. 12 h.p.)
Mattley Aviation Co.	Richmond and San Francisco, Cal.	Fields (public) second class, temporary	Temporary	1 Can. J.N. (OX5) 1 Can. J.N. (OX5)
Maxim Air Service Co.	Waterville, Me.	Field (leased) 2400 x 550	Repair shop, spare parts	1 L.S. (W. 150 h.p.) 2 Can. J.N. (OX5) 1 S.J.-1 (OX5)
Mayer Aircraft Corp., Inc.	Bridgeville, Pa.	Fields (owned), No. 1-30 acres; No. 2-65 acres; hangar 50 x 120		1 Oriole (C.-6) 1 S.J.-1 (Mer.) 1 S.J.-1 (OX5) 1 Swallow (OX5)
Michigan Aero Service Corp.	Lansing, Mich.	Fields (leased) Lansing, Battle Creek, Jackson, Detroit, 40 acres	Factory at Lansing	1 J.N.-4-D. (OX5) 3 S.J.-1 (OX5) 1 S.J.-1 (OXX6) 1 S.J.-1 (W. 220)

I — Continued

Total No. Flights	Average Duration of Flights	Total Mileage	Passengers Carried	Lbs. of Freight	Charge per Short Flight	Charge per lb. of Freight	Operating Territory	Charge per Mile Inter-city Flights
5,000	15 min.	60,000	3,000	0	\$5.00		All cities in Northwest	\$40.00 per hour
test flight	20 min.	15						
100	15 min.	1,500	100		5.00		Waco, Mexia, Fort Worth, Breckenridge	.75
2,500	30 min.	100,000	2,000		10.00		Wichita, Chicago, Kansas City, Tulsa, Omaha, Denver, etc.; anywhere All over U. S. A.	
300	varied up to 1 hr.	20,000	500		5.00 up			
1,500	varied up to 26 hrs. 19 min.	100,000	8,000		demonstration		Many trips N. Y.-Middle West, N. Y.-Chicago, N. Y.-Omaha; Transcontinental-N. Y.-San Francisco; Mexico City to Arctic Circle, etc.	
800	10 min.	8,000	460	0	5.00			.50
40 (sales demonstration)	15-20 min.	700	30					
50	30 min.	1,200	40		15.00 for 2		Central Kentucky	.50
300	30 min.	12,000	200	0	5.00 and 10.00		Texas, Oklahoma and Louisiana	.75
500	7 min.	5,000	442		5.00 to 10.00			.60
demonstration	varied 10 min. to 300 miles	30,000	500	0	10.00		Anywhere	
50	30 min.	2,500	15		10.00		Oberlin and Cleveland, O.	1.00
1,000 (100 averaging 1 1/2 hours)	10 min.	20,000	500	0	5.00-10.00			35.00 per ho
75	1-2 hrs.		0					
1,800	15 min.	27,000	2,000	10,000	10.00		Providence, R. I., Lawrence, Mass., etc.	.50
	10 min.	14,600	1,460		5.00 up		All points	1.00
	15 min.	35,000	800	0	10.00 to 15.00		Houston and surrounding country	.40
		3,000	150	0	10.00			
400	20 min.	8,500	450	100	10.00	vary	Northern Cal.	.50 to .75
700	15 min.	10,000	600	0	10.00		Central Maine	.75
600	20 min.	12,000		0	10.00		Pittsburgh and vicinity, east to Phila., west to Columbus and north to Buffalo	1.00
2,000	15 min.	30,000	1,200	175	10.00	.005	Battle Creek, Lansing, Jackson, all Michigan	.50

TABLE NO.

<i>Name of Company</i>	<i>Address</i>	<i>Air Port Facilities</i>	<i>Shop and Repair Facilities</i>	<i>Equipment</i>
Mobridge Aerial Co., Inc.	Mobridge, S.D.	Field (leased) 200 acres; hangar for 2 ships	Good	1 Can. J.N. (OXS) 1 L.S. (W. 150 hp.) (W. 220 hp. extra)
Nebraska Aircraft Corp. Netherlands Aircraft Mfg. Co. (Fokker)	Lincoln, Neb. 286 Fifth Ave., New York, N. Y.	Field (uses Curtiss Field, Mineola, L. I., N. Y.); 1½ hangars, rented, 60 x 80	Own personnel for repairs and overhauling Good	2 F-3 Monoplanes (BMW, 185 h.p.) 1 C-2 Biplane (BMW, 185 h.p.)
R. A. Northrup	Great Bend, Kan.	Field (leased) 622 x 1000; hangar 48 x 34	Good	1 Can. J.N. (OXS)
Nevada Aviation Corp.	Reno, Nev.	Fields Reno (Air Mail), Beowa, Nev., and Fallon, Nev. (private) and Yerrington, Nev. (city); hangar 30 x 40 at Yerrington	Shop at Reno, Nev.	2 J.N.-4-H. (W. Model A, 150 h.p.)
Newport News Aero Club	Newport News, Va.	Field (leased) 40 acres, rectangular; hangar for 4 planes	Complete	1 J.N.-4-D. (OXX6) 2 Can. J.N. (OXS)
New York Aircraft Exhibition Corp. Oakley & Askew Aerial Service	Troy, N. Y. Ardmore, Okla.	Field (leased) small Field (leased) 40 acres, 1 mile north of Ardmore; hangar 60 x 90	Good Engine and wing work	1 Can. J.N. (OXS) 2 Can. J.N.-4 (OXS) 1 L.S. Model E (W. 180 h.p.) 1 S.J.-1 (H.S.L. 6, 220 h.p.)
Oberlin Aircraft Co.	Oberlin, O.	Field (owned) 2 hangars, 80 x 100	Good	2 Can. J.N. (OXS) 1 S.J.-1 (Bn.) 1 J.N.-4 (OXS)
Oregon-Washington and Idaho Airplane Co.	Portland, Ore.	Field (leased) circular, 1300 x 700; 6 hangars, 1 water hangar (4 ships), office bldg.	Large shop, wood work and motor overhaul and testing building	3 Seagulls (K.-6 and C.-6) 2 F. Boats (OXX) 3 J.N.-4-D. (OXS) 4 S.J.-1 (OXS) 2 Can. J.N. (OXS) 3 Orioles (K.-6) (4 spare OXS and 1 K.-6)
Parker Aircraft Co.	Perry, Ia.	Field (leased) ground and basement; hangar 45 x 50	30 x 60	1 Can. J.N. (OXS) 1 J.N.-4-D. (OXS)
Sidney E. Parker	Lake Placid, N. Y., and Montreal, Can.	Dock at Lake Placid		1 D.H.-6 (OXS) 1 Seagull (K.-6) 1 504-K (Le R. 110 h.p.) 3 504-K (Cl. 180 h.p.)
Penn Aero Corp. T. C. Peterson	Huntingdon, Pa., and Lancaster, Pa. Santa Ana, Cal.	Field (leased) 1500 x 2000; hangar 75 x 100 Field (leased) 400 x 1200	Small repair shop Temporary	1 S.J.-1 (OXS) 1 J.N.-4-D. (OXS) 1 P.S., 3-place (OXS)
Pioneer Aero Co., Inc.	41 Willow Ave., Plainfield, N. J.	Field (owned) 856 x 300; hangar 42 x 42		1 D.H.-6 (OXS)
Robertson Aircraft Corp., Inc.	5248 Oakland Ave., St. Louis, Mo.	Fields (municipal) 60 acres; Flying Club of St. Louis, 183 acres; 2 hangars, for 3 ships each	Good; opposite municipal land. fld.	3 J.N.-4-D. (OXS) 2 J.N.-4-C. (OXS) 1 Oriole (K.-6)
Rogers Aircraft, Inc.	Venice, Cal.	Field, Rogers Airport, Los Angeles (leased), 73 acres; 7 hangars, housing 22 planes	Factory 10,000 sq. ft.; complete repair facilities	1 St. (St. 140 h.p.) 4 P.S. (OXS) 1 P.S. (C.-1) 2 N. 28 (Gn. 160 h.p.)
Roeswift Airplane Co., Inc.	Grand Rapids, Mich.	Field 2700 x 2000; hangar 50 x 100	Work shop for repairing motors	3 S.J.-1 (OXS and OXX6)
Basil L. Rowe Harold G. Peterson Aircraft Co., Inc.	Sidney, N. Y. White Bear Lake, Minn.	Field (leased) 2000 x 500 Field (leased) 30 acres; hangar 66 x 66	Shop 50 x 16	1 D.H.-6 (OXX6) 1 Can. J.N. (OXS) 2 L.W.F. (C2X) 1 Sop., 3-seater (Cl. 130 h.p.) 1 N., 2-seater (Le R. 80 h.p.) 1 Scout (Gn. 50 h.p.) 1 504-K, 3-place (LeR.)
Runser & Turner	Columbia, S. C.			



Curtiss "*Wildcat*," Curtiss 400 h.p. C. D.-12 engine, winner of second place, Pulitzer race, 1921; speed 170.26 m.p.h.



Dayton Wright "*Chummy*," 80 h.p. Le Rhone engine; accommodating two passengers and pilot.

I — Continued

Total No. Flights	Average Duration of Flights	Total Mileage	Passengers Carried	Lbs. of Freight	Charge per Short Flight	Charge per lb. of Freight	Operating Territory	Charge per Mile Inter-city Flights
200	10	2,000	100	0	\$10.00			
215 From July 21, 1921	31 min.	10,000	812		demonstration		N. Y.—Philadelphia N. Y.—Washington Philadelphia—Washington N. Y.—Hartford N. Y.—Providence Great Bend to Hutchinson, Wichita, LaCrosse, Kansas City Nevada	\$.50 1.00
100	15 min.	7,500	100	0	7.50			
500	15 min. up (cross country)	4,000	400	0	15.00			
200	20 min.	24,000	500	very little	10.00			.50 to 1.00
350	12-15 min.		120		10.00		Troy, Albany and Vicinity	
800	30 min.	27,000	1,000	0	5.00		Ardmore, Oklahoma City, Dallas, Ft. Worth, Texarkana, Wichita Falls, etc.	20.00 per hour
800	3 hrs.	5,000	400		10.00 and 20.00		North to South	
2,000	30 min.	80,000	1,500	26,000 lbs. papers	10.00		Portland, Astoria, Seaside (daily), St. Helena, Rainier, Oregon City, Salem, Corvallis, Eugene, The Dalles, Pendleton, La Grande, Tacoma	Based on character of country
263	16½ min.	3,450	247		5.00 to 10.00		Anywhere	.15
1,500	25 min.	40,000	900		10.00		N. Y.—Montreal, Lake Placid, Burlington, Vt.; lake to lake in Adirondacks	.50
800	12 min.	10,000	700	500	10.00		Huntington to Lancaster	.50
600	20 min.	12,000	1,000		5.00		San Diego, Los Angeles, San Francisco and intermediate cities	.50
100	1 hr.	7,500	50		0		Plainfield, Atlantic City and Hasbrouck Heights	
5,000	10 min.	35,000	1,000	3,000	.50-1.00	\$.35	St. Louis to Chicago, St. Louis to Kansas City, St. Louis to Memphis, St. Louis to Indianapolis, Los Angeles and San Diego—San Francisco	.50-1 .30-2 .30
7,240	14 min.	101,360	10,860	0	5.00			
250	15 min.	6,000	150	0	10.00		Charlevoix, Ionia, Muskegon	.50
350	10 min.	5,000	500	0	10.00			
600	30 min.	21,000	500	0	7.50			.50-1 .35-2
		25,000	500	0	10.00 to 20.00		Throughout Southeastern states	.50

TABLE NO.

<i>Name of Company</i>	<i>Address</i>	<i>Air Port Facilities</i>	<i>Shop and Repair Facilities</i>	<i>Equipment</i>
Foster Russell Aviation Co., Inc.	Spokane, Wash.	Field (leased) 800 x 2500; 1 hangar for 4 planes, 1 tent hangar for 1 plane	Good	1 J.N.-4-D. (OX5) 1 S.J.-1 (OX5) 1 S.J.-1 (K.-6) 1 S.J.-1 (OX5) 1 Swallow 1 Seagull (C.-6)
R. W. Schroeder	2276 Logan Blvd., Chicago, Ill.	Terminal Lake, Washington; hangar		2 S.J.-1 (H.S.) 1 S.J.-1 (OX5) 1 Can. J.N.
Seattle & Puget Sound Airway Co.	1519 3d Ave., Seattle, Wash.	Field (municipal) at Aberdeen, 100 acres		1 Can. J.N. (OX5)
Security Skycraft Co.	Aberdeen, S. D. Fargo, N. D.			
Seery Aviation Co.	Sault Ste. Marie, Mich.	Field (leased) 60 acres		
Sheldon Air Line	Sheldon, Ill.	Field (owned) 1320 x 660, perfect approach	Machine shop, spares, etc.	4 J.N.-4-C. (remodeled) (OX5)
Sierra Aircraft Co.	Pasadena, Cal.	Field (leased) Foothill Blvd., 3 miles E. center Pasadena, 65 acres; 3 hangars, 50' doorways	Good	1 S.J.-1 (K.-6) 1 J.N.-4-D. (OX5) 1 S.J.-1 (OXX6)
(Miss) Neta Snook Aircraft Co.	Huntington Park, Cal.	Field (Goodyear) leased, 300 acres; hangar 40 x 150		1 Can. J.N. (OX5)
Southern Aircraft Co.	Houston, Tex.	Field (leased) 20 acres, adjoining field 150 acres; hangar for 8 planes	Fair	4 Can. J.N. (OX5) 1 S.J.-1 (OX5)
Southwest Airplane Co., Inc.	Tulsa, Okla.	Field (owned) 120 acres; 2 hangars (steel) 90 x 65	Motor and Wing and Fuselage Shop	1 S.J.-1 (K.-6) 1 Br. 3 J.N.-4-D. 1 C. Scout 1 Oriole (K.-6) 1 Can. J.N.
Lawrence Sperry Aircraft Co.	Farmingdale, L.I., N.Y.	Field (leased) 1800 x 2400; hangar (leased) at Curtiss Field	Complete for manufacture and repair	1 Sp. Sport (Law. 60 h.p.) Many 504-K (Le R. 110 h.p.) (Detachable High Lift Wing) J.N.-4D's (OX5) J.N.-4-C's (OX5) S.J.-1 (W.) 1 S.J.-1 (OXX6)
Standard Airplane Co.	Dallas, Tex.	Field (leased) 100 acres		
Marion Sterling	Waco, Tex.	Field 25 acres; hangar	Private	
St. Louis Curtiss Airplane Co.	St. Louis, Mo.	Field (municipal) 1000 x 1500	Limited	1 J.N.-4-C.
St. Petersburg Air Boat Line	St. Petersburg, Fla.	Terminal (owned) 50 x 40	Good	1 C.F. Boat (two W.) 2 J.N. (OX)
Strubler Aero Co.	Colorado Springs, Colo.	Field (leased) 270 acres; hangar for 2 planes	Very little	1 Oriole (C.-6) 1 A. (T.M.)
Max Short	Salina, Kan.	Field (leased) 40 acres	Motor and plane overhauling	1 Can. J.N.-4-D. (OX5)
Tennant Bros.	Sioux Falls, S. D.	Field (leased) 40 acres; hangar 30 x 50	Private	1 J.N.-4-D. (OX5) 1 Can. J.N. (OX5)
United States Aircraft Corp.	1803 3d Ave., Spokane, Wash.	Field (municipal) 1000 acres; hangar 100 x 50	Machine shop welding, all facilities	2 S.J.-1 (H.S.L.-4) 1 S.J.-1 (H.S.L.-6) (2 L. 1½ h.p.) (2 Le R.) (4 H.S. 97-A.) (2 H.S.-ASA.)
Walter T. Varney	832 Post St., San Francisco, Cal.	Field (leased) San Carlos, 2000 x 6000; hangar for 15 planes	Excellent; shop 30 x 300	1 Br. 3 V. (W. 220 h.p.) 8 V. (W. 150 h.p.)
William Westlake	1446 Chase Ave., Chicago, Ill.	Field (leased) 50 acres; tent hangar		1 J.N.-4-D. School Ship 1 J.N.-4-D. (OX5)
White's Aircraft	Des Moines, Ia.	Field (leased) 80 acres; 2 hangars (portable)	Complete repair shop	1 Can. J.N. (OX5) 3 J.N.-4-D. (OX5) 1 Sport Monoplane (own manufacture) (25 h.p.) 1 Special Monoplane (St. 5A.)
Whitted Air Line	St. Petersburg, Fla.	Field (leased) 50 x 100; hangar (owned) 50 x 100	Good	1 C.F. Boat 1 A.39-A. (W. 150 h.p.) (two OXX6)

I — Continued

Total No. Flights	Average Duration of Flights	Total Mileage	Passengers Carried	Lbs. of Freight	Charge per Short Flight	Charge per lb. of Freight	Operating Territory	Charge per Mile Inter-city Flights
3,075	10 min.	32,500	2,575	0	\$5.00 and 10.00		100 towns in Eastern Washington and Northern Idaho	\$.50
18	1 hr.	1,500	10					
310	15 min.	5,800	620		5.00			
1,000	30 min.	6,000	980		10.00-2		Fargo, N. D., and Aberdeen, S. D.	.50-2 .40-1
50	10 min.	1,500	40	0	10.00		Northern Michigan	1.00 or .60 round trip
700	15 min.	18,750	300	2,000	5.00			
1,500	15 min.	30,000	1,200	0	5.00		Pasadena, San Diego, San Francisco, Fresno, etc.	.35 up
1,000	7 min.	6,000	183		5.00		Los Angeles, Venice, Beverly Hills, San Bernardino, Riverside, Alhambra	.50
1,000	30-45 min.	20,000	1,200	very little	7.50		All Texas and some Louisiana cities	.30
1,100	10 min. to 3 hrs.	25,000	1,500	1,000	15.00-2	vary	Entire Southwest, Kansas City, Dallas, Houston, Oklahoma City, etc.	.50
612	25 min.	12,600	500	0			Farmingdale to Garden City, Washington, D. C., and Hampton Roads, Va.	
600	25 min.	16,000	900		5.00 and 10.00			.50
200	10 min. to 2 hrs.	7,500	100	very little	5.00		Mexia, Dallas, Austin, etc.	.50
1,000	15 min.	15,000	1,000	0	5.00 and 10.00	.00¼	Within 1000 mile radius	.50 one way .30 round trip
500	10-15 min.	7,500	450		15.00		Tampa, St. Petersburg, Key West, Havana and Coastwise	1.00 per min.
150	15 min.	2,000	300	0	10.00		Denver, Colo. Springs, Pueblo	.75-1.00 per min.
100 hrs.	2 hrs.	1,600	50	100	7.50	.75	Manhattan, Kan., Kansas City, Omaha, Lincoln, Wichita, etc.	.75 one way .50 round trip
1,600	10 min. to 1 hr.	20,000	1,500		5.00 and 10.00		Throughout S. Dakota, Western Minnesota and Iowa	.60 min. 45.00 hr.
500	40 min.	20,000	350	500	5.00 and 10.00		Spokane, Lewiston, Seattle, Kalispel, Eureka, Helena, Great Falls, Missoula, Wenatchee, Colfax	.30
6,000	10 min.	200,000	1,000		10.00		Los Angeles, Yosemite, Portland, Reno, etc.	.50 to 1.00
500	10-15 min.	7,500	500	0	10.00		Chicago, Evanston, Milwaukee	.60
215	10 min.	5,000	153		5.00 and 10.00		Anywhere; cross country	.25
1,100	12 min.	13,000	1,250		10.00 and 15.00		Tampa, Clearwater, Pensacola	1.00 less 10%

TABLE NO.

<i>Name of Company</i>	<i>Address</i>	<i>Air Port Facilities</i>	<i>Shop and Repair Facilities</i>	<i>Equipment</i>
Wittmann Aircraft Corp.	Hasbrouck Heights, N. J.	Field 5000 x 8000; 800 acres; hangars	Complete factory and assembly floor	5 D.H.-6 (OX5)
Wood & Gallatin C. B. Wrightman	2620 Main St., Buffalo, N. Y. Tulsa, Okla.	Field (Curtiss Southwest Airplane Co.)		1 S.J.-1 (OX) 1 S.J.-1 (W. 150 h.p.) 2 S.V.A.-9 1 S.J.-1 (OXX)
Total Operators, 125		Total terminals, 146, including 116 land, 30 sea, of which 16 were public		Between 500-600

KEY TO AIRCRAFT AND ENGINE TYPES

AIRPLANES AND SEAPLANES

A., A.-Navy, A.-Navy-H. S. and A.-39-B.; Aeromarine Plane & Motor Co., Keyport, N. J.
 An.; Ansaldo; Ansaldo Co.; 65 Broadway, New York City.
 Balilla Racer; Ansaldo.
 B., and C. L-4-S.; Boeing Airplane Company, Seattle, Wash.
Blue Bird, Ashmussen Aeronautical Company, Omaha, Nebr.
 Br. Bomber; Breguet.
 Br. and Bullet Monoplane; Bristol.
 Camel; Sopwith.
 D. H.-6 and D.; DeHaviland.
 D. Special; Earl S. Daugherty, Long Beach, Cal.
 F.-3 Monoplane and C.-2 Biplane; Netherlands Aircraft Mfg. Co., Fokker, New York City.
 F.-40 and Sport F.; W. Wallace Kellett, representing H. and M. Farman.
 J.L.-6 and J.L.-12; J. L. Aircraft Corporation, New York City.
 J.N., Can. J.N., S.J., J.N.-4-D, J.N.-4-C, J.N.-4-H., D. Pusher, Navy Racers, C.T. Monoplane, C. Scout, *Orioles*, *Seagulls*, *F. Boats*; Curtiss Aeroplane & Motor Corp., Garden City, Long Island, N. Y.
 K.T. and O.W.; Dayton Wright Company, Dayton, O.
 L.H., L.A.K.; Longren Aircraft Corp., Topeka, Kan.
 L.S.; Lincoln Standard; Nebraska Aircraft Corp., Lincoln, Nebr.
 L.W.F.; L.W.F. Engineering Company, College Point, New York.
 N.28; Nieuport.
Oreoca; Ordnance Engineering Corp., Baldwin, L. I., N. Y.
 P. Special; Earl S. Daugherty, Long Beach, Cal.
 P.S.; Pacific Standard; Pacific Aeroplane & Supply Co., Venice, Cal.
 R.B., Remington-Burnelli; Vincent J. Burnelli, Amityville, N. Y.
 Sp. Sport Plane; Lawrence Sperry Aircraft Corp., Farmingdale, L. I., N. Y.
 St., Sturtevant; Sturtevant Aeroplane Company, Hyde Park District, Boston 36, Mass.
 S. V. A.; Ansaldo.
Swallow; E. M. Laird Company, Wichita, Kan.
 T.M., Thomas-Morse; Thomas-Morse Aircraft Corp., Ithaca, N. Y.
 U.E.; United Eastern.
 V., Walter T. Varney, San Francisco, Cal.
 504-K.; British Avro.

I — Continued

Total No. Flights	Average Duration of Flights	Total Mileage	Passengers Carried	Lbs. of Freight	Charge per Short Flight	Charge per lb. of Freight	Operating Territory	Charge per Mile Inter-city Flights
500	20 min. to 3 hrs.	7,500	200	0	demonstration		Hasbrouck Heights and Washington; Hasbrouck Heights and Mineola	
1,500	20 min. to 30 min.	50,000 25,000	1,600 50	0	\$10.00 and 15.00 0		Eastern states, between New York and Florida	\$.80-2 1.00-1
130,736	21	2,907,245	122,512	123,221	9.00	.33 +		.55 +

AIRCRAFT

Pony Blimp; Goodyear Tire & Rubber Company, Akron, O.

ENGINES

An.; Anzani.
 Bd.; Beardmore.
 B. M. W.; J. L. Aircraft Corp., N. Y. City.
 Bu.; Benx.
 Cl.; Clerget.
 Gn.; Gnome.
 H.S.; H.S. A-5A; Hall Scott Motor Car Co., Berkeley, Cal.
 Law.; Lawrance Aero-Engine Corp., Farmingdale, L. I., N. Y.
 LeR.; LeRhone.
 L-12; Liberty; Packard Motor Car Company, Detroit, Mich. and others.
 Mer.; Mercedes.
 OX, OXX, OX5, OXX6, K.-6, C.-6, V2X; Curtiss Aeroplane & Motor Corp., Garden City
 L. I., N. Y.
 Sal.; Salmson.
 Stur.; Sturtevant Aeroplane Company, Hyde Park District, Boston 36, Mass.
 S.P.; Siddeley Puma.
 S.V.A.; Ansaldo.
 T.M.; Thomas-Morse Aircraft Corp., Ithaca, N. Y.
 W.; Wright Aeronautical Corporation, Paterson, N. J.

(The above is based upon statements made to the Manufacturers Aircraft Association, Inc., and the Aeronautical Chamber of Commerce of America, Inc., in response to questionnaires sent to all known operators of aircraft. No opportunity has been available to determine the accuracy of the information and no responsibility is taken for the data except for the care with which the figures and facts are reported and the manner in which the summary is presented.)

CHAPTER II

CAPITAL—TERMINALS—RELIABILITY—NEEDS WHICH CAN BE MET THROUGH AERIAL LAW—ANALYSIS OF HAZARD IN FLIGHT

THREE deficiencies operate to the serious embarrassment of American aviation—meager capital, insufficient terminal facilities and popular doubt as to reliability. The correction of these deficiencies and the consequent opportunity for the rapid growth of aerial transport depend upon Federal regulation and reasonable control through an Aerial Code.

The writer in *Commerce Monthly*, referred to in the preceding chapter, observed:

“Wise regulation may be expected to give a certain stability to the air transportation industry essential to any industry which must appeal for credit and for investment capital. Until this is attained air transportation cannot be said to be on a business basis. From whatever point of view the subject is approached, the conclusion is inescapable that the enactment of an air law is the first essential step toward the development of commercial aviation in the United States.”

The experiences of the inland waterways and the railroads in either burdening themselves with huge terminal debts, or in struggling selfishly for the exclusive control of available sites, a control which meant private monopoly and this, in turn, public burden, point the way for the sound economic treatment of the air port problem. The establishment of common terminals for the encouragement of all aviation, and for the national security in time of need, is a public responsibility, which, if neglected now, will invite difficulties within a few years similar to those in which the waterways and the railways now find themselves.

At the close of 1920, operating reports showed the existence of 128 terminals of all classes, of which 5 were in Canada, and 3 others devoted to airship experiment, leaving a net of 120 in the United States. Of this number, probably 20 could be classified as seaplane bases.

At the close of 1921, the operating reports showed a total of 146 air terminals, both land and water, within the United States. All were for heavier-than-air-craft. This is an increase of 26 over the

preceding year. Of the total number, 30 were classified as seaplane bases. Sixteen of the 146 were publicly owned or controlled.

Deprive the rail and ocean carriers of depots and docks, and operation must cease. Withhold terminals from the American aircraft industry, and aerial transport can achieve neither size nor reliability. The 146 terminals reported available to commercial aircraft in the United States represent the facilities for 600 machines without regard to geographical or business requirements. The wonder is that there has been so much paid flying from so few fields.

The Airways Section of the U. S. Air Service, under Captain Burdette Wright and Captain St. Clair Street,[†] is, in the absence of a centralized civilian authority functioning on behalf of commercial aviation, endeavoring to encourage the development of our air terminals. The Airways Section, relying on voluntary local reports, is taking a census of available sites (see Appendix), and is providing practical construction and flying advice to municipalities and to private enterprise.

On July 18, 1921, an Air Law conference was held in the office of Secretary of Commerce Herbert Hoover. It was participated in by representatives of the Aero Club of America, the Manufacturers Aircraft Association, National Aircraft Underwriters Association and the Society of Automotive Engineers. Practically the first inquiry Mr. Hoover made, after listening to a statement of the general situation, was whether the most urgent need for regulation was the protection of public life and property, and at his request, the Manufacturers Aircraft Association, and later the Aeronautical Chamber of Commerce, conducted a survey of hazard in unregulated flight, which is presented in full in this chapter.

As a result of this conference, a bill was drafted with the co-operation of the War, Navy and Post Office Departments and the National Advisory Committee for Aeronautics, and introduced by Senator Wadsworth (S. 3076; see Appendix). The bill passed the Senate and at the time of publication was before the House Committee on Interstate and Foreign Commerce. It provides for the regulation of aircraft engaged in interstate and foreign commerce and for the establishment of a Bureau of Civil Aeronautics in the Department of Commerce. Its enactment will give the assurance of legality which is necessary before investment capital can be attracted. It will make possible the systematic establishment of terminals and, perhaps most important of all, will remove the last vestige of fear from the mind of a public only too vividly impressed with the perils of uncontrolled flight.

Following is the report made to Secretary Hoover :

TABLE NO. II.—ACCIDENTS REPORTED BY 125 ESTABLISHED OPERATING COMPANIES

Number	Fatalities	Injuries	Cause										Remarks	
			Lack of Public Landing Fields	Lack of Air Routes	Lack of Weather Reports	Poor Judgment by Pilot	Carelessness on Field	Failure of Accessory	Failure of Plane	Failure of Engine	Failure of Gasoline or Oil	Stunting		Storm on Field
1		1				1		1		1				Ignition.
2		1												Into spin at 1500 feet.
3	1	1												Faulty fitting on fin; spun 1900 feet.
4		1												Field, buildings and blimp destroyed by cyclone and lightning.
5		1	1	1										Lost way, gas gone, no field.
6	1									1				Lost control stunting.
7		1												Motor cut out on test flight.
8		1												Side slip close to ground.
9		1							1					Control stick buckled.
10		1												Mechanic loses fingers in engine.
11	1	1											1	Ships collide while stunting.
12	1	1												Passenger stepped into propeller.
13	1	1											1	Parachute jumper drowned.
14		1				1								Slight.
15		1				1						1		Water in carburetor, forced landing.
16		1												Pilot hit by propeller.
17		1						1						Ship caught fire at 1400 feet, pilot prevents passenger from jumping, and then makes perfect landing.
18		1										1		Side slipped into rough field.
19		1												Arm broken by propeller.
20		1												Intoxicated man walks into propeller.
21		1												Propeller strikes mechanic.
22		1				1								Night flying.
23		1												Man's leg broken by propeller.
24		2	1									1		Field too small, hazardous.
	6	21	2	1	0	5	7	2	1	3	3	3	3	1



Gallaudet Multiple Drive. Three Liberty engines geared to one propeller, making a total of 1,200 h.p. in one power unit.



Aeromarine Cruiser, two 400 h.p. Liberty engines, leaving Havana Harbor; Morro Castle in background.

"In preparing the data, the worst obstacle encountered in research and analysis was the lack of official machinery with which to obtain thorough and authentic information. Two courses were open—confidential data (as to identification) from the established companies making operating reports; and press stories, covering the general field. It is important to state at this point and to bear continually in mind that the press stories (with the exception of less than half a dozen fatalities) refer wholly to the gypsy flier and thus prove conclusively that the uncontrolled itinerant pilot encounters and causes most of the danger in flying.

"One hundred twenty-five established companies, operating 500 to 600 two- and three-place machines, made 130,736 flights, covering 2,907,245 miles and carrying 122,512 passengers in the twelve months Oct. 1, 1920–Oct. 1, 1921. In making their reports, these companies seemed careful to itemize all forced landings, crashes, etc. Yet the number of accidents in which persons were killed or injured totals but 24.

SIX REQUISITES FOR SAFE FLYING

"Experience has taught that, in safe flying, there are the following requisites:

- "1. A machine sound, aerodynamically and structurally.
- "2. An engine of sufficient power and which operates satisfactorily.
- "3. A competent, conservative pilot and navigator.
- "4. Air ports and emergency landing fields, sufficiently close together to insure gliding to safety.
- "5. Nation-wide weather forecasts specialized and adapted to the need of flyers.
- "6. Nation-wide chart of air routes.

"Table No. 2 illustrates the causes to which the 24 accidents are attributed. Of the six fatalities, three were due to stunting, two to gross carelessness on the field, and one to storm. Not a single person, passenger or pilot, lost his life in straight commercial flying. And with Federal regulation, controlling stunting and enforcing proper field policing and protection, it is believed certain most of these fatalities could have been avoided.

"There were 21 persons injured in the 24 accidents. As the table shows, these mishaps were due to causes which could have been removed by Federal regulation or supervision,—had landing fields, air routes and weather reports been fully available; had the field help been more disciplined; had the pilots been more alert through consciousness of licensed responsibility and had there been strict inspection of aircraft, engines, accessories and supplies.

"These deficiencies, as compared with the requisites for safe flying, will be more carefully discussed later, when the case of the irresponsible itinerant is taken up, for it is he, rather than the established, incorporated company, that demands control.

122,512 FLEW; NOT ONE KILLED

"Yet, even, conceding the foregoing, it is found that during twelve months, 500 to 600 commercial aircraft made 130,736 flights, traveling 2,907,245 miles, carrying 122,512 passengers (men, women and children) without a single fatality in flight.

"Out of these 122,512 people, only 21 were injured in flying and in ground accidents, combined, or a ratio of

1 fatality to 130,736 flights, and 2,907,245 miles flown, and
1 injury to 6,701 flights, and 138,440 miles flown.

THE CASE OF THE GYPSY FLIER

"It is estimated that, during the calendar year 1921, 1,200 aircraft were engaged in civil flying in the United States and that these flew 6,500,000 miles and carried 250,000 persons. These figures are approximate and include both the itinerant and fixed base flying. Many press reports may be inaccurate and unfair as to causes, but they afford the only available index into the comparative safety of the total aerial activity.

"Table No. 3 shows that 114 accidents occurred, not including those that involved Government-owned aircraft. Two of the 114 occurred in January, 1 in February, 2 in March, 6 in April, 16 in May, 13 in June, 13 in July, 28 in August, 16 in September, 8 in October, 8 in November and 1 in December, progressing and diminishing as the flying season advanced and waned. The accidents were reported from all parts of the United States—30 being in the East, 43 in the Middle West (which has most of the machines, and, generally speaking, the best natural landing fields) and 41 in the Far West.

WHAT CAUSED THE ACCIDENTS

"The 114 accidents resulted in death to 49 persons and injury, more or less serious, to 89. In 48 instances there were no casualties. The 49 lives were lost in 33 accidents and injury to the 89 persons was caused in but 42 accidents.

"Each of the 114 accidents recorded was caused by deficiency in one or more of the six necessary requisites for safe flying. Forty-nine were attributed to the pilot, perhaps through carelessness, perhaps incompetence, perhaps bad judgment combined with other factors. There is no doubt that a good pilot can guide a poor machine to safety with greater chance of success than a poor pilot can operate a first-class craft. Therefore, at the very top of the list of Governmental needs we place the Federal examination and licensing of pilots. During the war rather more than 17,000 young men were trained to fly. The knack of flying cannot be retained perpetually without practice, nor can it be maintained at a high degree of competency without regular examination on a common standard for all flying throughout the United States. The same is true of aerial navigators. Both pilot and navigator (many times they are identical) are of equal importance in safeguarding the lives of travelers by air.

INADEQUATE LANDING FIELDS

"Twenty accidents are attributed in whole or in part to inadequate landing fields or to the total lack of terminal facilities. Here is a duty directly imposed upon the Federal Government. During the war the Army and the Navy acquired many terminals, most of which have since been abandoned. The fragmentary remainder has been slightly added to by the Air Mail, municipalities and private enterprise, but the United States is today woefully lacking in air ports for even the 1200 craft in operation.

TABLE NO. III. — CHART OF AIRCRAFT ACCIDENTS, FROM JANUARY 1 TO DECEMBER 31, 1921
(Prepared for the Secretary of Commerce, by the Aeronautical Chamber of Commerce of America, Inc., 501 Fifth Avenue, New York City)

Num- ber	Date	Locality	Killed	Injured	Causes										Remarks	
					Pilot	Field	Lack of Weather Data	Lack of Route Data or Flying Rules	Faulty Craft	Faulty Engine	Faulty Accessory	Stunting	Collision in Air	Carelessness on Field		Unknown
1	1921															
1	Jan. 9	Tiptonville, Tenn.	2	2											1	Seaplane caught fire and crashed to river; cause of fire unknown
2	Jan. 21	Macon, Ga.		3		1			1	1						Forced to land near street; lives endangered; regulations and emergency field lacking
3	Feb. 19	Portland, Ore.														Seaplane lands on beach and kills woman gathering shells
4	Mar. 13	Jacksonville, Fla.	1	2	1	1							1			Flew into snowstorm; engine trouble; tries to land on ice
5	Mar. 20	Cloquet, Minn.		1	1		1									Stunting
6	April 2	Bridgeville, Pa.														Series of three accidents within month; probably old plane, carelessness
7	April 20	Hampton, N. J.									1	1				Inadequate terminal facilities
8	"	"			1	1										Bad take-off with seaplane
9	April 23	Council Bluffs, Ia.														Stunting
10	April 28	Seattle, Wash.			1								1		1	Seaplane crashes into lake
11	May 5	Lincoln, Neb.	1	2				1	1		1					Gas tank bursts; forced landing on athletic field during meet
12	May 7	Waukegan, Ill.														Inadequate field
13	May 7	Richmond, Cal.	2	1		1									1	Bad landing; seaplane
14	May 8	Arlene, Texas														Probably poor piloting; attempted to turn while too low
15	May 11	Sandpoint, Ida.			1	1							1	1		Stunting; fliers crash in mid-air
16	May 12	Utica, N. Y.		1	1								1			Junk machine; weather-worn; gross neglect and defiance of safety rules
17	May 13	Sandpoint, Ida.		1					1							Engine reported to have stalled
18	May 15	Grand Island, Neb.	1	1	1											Engine reported to have stalled
19	May 15	Paterson, N. J.	2		1					1	1					Probably due more to field than pilot
20	May 20	Bloomington, Ill.														Reported "air pocket"; probably poor piloting
21	May 22	Chicago, Ill.		2		1										Probable combination of bad judgment and poor field
22	May 24	Nogales, Ariz.		2	1	1										Plane crashes into grandstand; attempted change from auto to plane
23	May 27	Augusta, Ky.		1	1	1										Plane flies low and slowly to take movies of motorcycle races; falls
24	May 27	Minneapolis, Minn.		16	1	1							1			Plane reported in bad condition; lack of inspection
25	May 28	Milwaukee, Wis.		3	1											Crowd surged onto field; pilot wrecks plane to save people
26	May 29	Portland, Ore.														Stunting
27	May 31	Hackensack, N. J.		2	1				1						1	
28	June 1	Dothan, Ala.			1											
29	June 3	Garden City, N. Y.	1													
30	June 5															

TABLE NO. III. — Continued

Name- ber	Date	Locality	Killed	Injured	Causes								Remarks		
					Pilot	Field	Lack of Weather Data	Lack of Route Data or Flying Rules	Really Craft	Really Engine	Really Accessory	Swinging		Collision in Air	Carelessness on Field	Unknown
31	June 5	Salisbury, Mass.	1		1										Stunting; parachute drops into sea
32	June 5	Huntington Beach, Cal.	1	8	1			1							Machine reported stunting; falls into crowd on beach
33	June 12	Broadview, Mont.		1	1	1									Probably bad judgment; turned too low
34	June 12	Ononomowoc, Wis.													Hit tree landing; probably bad judgment and poor field
35	June 19	Moline, Ill.			1										Reported magneto trouble; noticed but ignored by pilot
36	June 20	Troy, N. Y.	2		1					1					Probably bad judgment; crash into Hudson River
37	June 23	Sandpoint, Ida.			1										Inadequate field
38	June 23	Atlantic City, N. J.		1											Movie actor thrusts hand into propeller
39	June 24	Seattle, Wash.		1											Probably inspection
40	June 30	New Albany, Ind.		1											Lacking route, fliers lost way; no identification on towns; no field; bad landing
41	July 1	Elmira, Wash.		1	1										Crowded field; plane crashes into motor car taking off
42	July 4	Choteau, Mont.			1	1									Gypsy fliers land on race track where children were playing; propeller beheads 7-year-old boy
43	July 7	North Bergen, N. J.	1	2	1	1									Flier carrying passengers over marshes; lack of inspection for machine and examination for pilot
44	July 7	Brooklyn, N. Y.			1					1	1				Plane crashes, striking high voltage wires; exact causes unknown but believed to be due to lack of proper inspection
45	July 14	Modesto, Cal.	4		1				1	1	1				Engine or accessory trouble causes forced landing
46	July 21	New York City			1										Plane stalls
47	July 24	Washington, D. C.	1	1	1			1							Plane over city; forced to descend; lands in street, crashing into trolley car
48	July 25	San Francisco, Cal.			1										Bad take-off; second accident in month; same pilot and plane
49	July 28	Choteau, Mont.			1										First flight; bad judgment; no inspection (seaplane)
50	July 28	Monroe, Wash.			1										Plane racing with passenger
51	July 30	Denver, Colo.			1							1			Stunt flying
52	July 30	Pawnee, Okla.	2		1										Bad landing in seaplane
53	July 30	New York City			1										Lack of inspection probably
54	Aug. 1	Montgomery, Mich.													Lack of inspection probably
55	Aug. 3	Bristol, Va.													Evidently bad take-off
56	Aug. 6	Forest Park, Ill.	1	1	1										Struck by propeller while cranking
57	Aug. 8	Los Angeles, Cal.			1										Pilot stunting at low altitude when plane falls and burns
58	Aug. 8	Petaluma, Cal.	3	1											Improperly adjusted propeller; forced landing by seaplane
59	Aug. 8	Redwood City, Cal.									1				Evidently bad landing
60	Aug. 9	Bosman, Mont.			1										

TABLE NO. III. — Continued

Num-ber	Date	Locality	Killed	Injured	Causes								Remarks			
					Pilot	Field	Lack of Weather Data	Lack of Route Data or Flying Rules	Faulty Craft	Faulty Engine	Faulty Accessory	Stunting		Collision in Air	Carelessness on Field	Unknown
61	Aug. 10	Claysville, O.		2	1			1			1					Tire explodes on take-off; evidently poor field
62	Aug. 11	Livingston, Mont.														Gypsy flier crashes in Yellowstone Park; lack of route and probably carelessness
63	Aug. 11	Mason City, Iowa.	2	1									1			Accident caused by attempt to change planes in air; machines crash
64	Aug. 11	Iowa Falls, Iowa.														Bad take-off for stunt flight
65	Aug. 11	Iowa Falls, Iowa.											1			Plane has forced landing, attempting to fill place of preceding stunt flier
66	Aug. 14	San Francisco, Cal.	1	1									1			Little girl killed; father, pilot, hurt, in stunt flight
67	Aug. 14	Stoughton, Wis.			1	1										Poor field and bad take-off
68	Aug. 14	Bellingham, Wash.											1			Overloaded machine; poor field; bad take-off
69	Aug. 17	Fairmont, Minn.											1			Plane crashes into lake during stunts
70	Aug. 18	Richford, Ill.	1										1			Parachute jump in stunt flight
71	Aug. 19	Preston, Minn.	2													Probably lack of inspection of machine, and lack of examination of pilot
72	Aug. 19	Ferndale, Wash.			1	1										Probably poor field and bad judgment
73	Aug. 20	New Orleans, La.			1											"Home-made" airplane, with negro pilot, strikes tree taking-off
74	Aug. 21	Rockford, Ill.		1												Stunt flier falls in attempt to change from motor car to plane
75	Aug. 21	Sioux City, Ia.		2												Believed passenger interfered with controls during flight
76	Aug. 21	Chetek, Wis.				1		1								Itinerant plane without benefit of route or emergency landing field
77	Aug. 23	Sea Isle City, N. J.			1											Three narrowly escape drowning, through low flying over sea
78	Aug. 24	Eaton Rapids, Mich.			1											Probably bad take-off and poor judgment
79	Aug. 25	Winona Lake, Ind.	2		1											Student pilot probably to blame
80	Aug. 27	Yaquina, Ore.														Engine of gasoline truck permitted to run while fuel is placed in plane; plane burns
81	Aug. 28	Philadelphia, Pa.	3		1											One of victims a child; gas tank reported empty, handicapping pilot; coroner thinks pilot was ill
82	Sept. 2	Beeville, Tex.	1		1											Attempts to fly plane that had been exposed to weather for months; crashes and burns
83	Sept. 2	Camden, N. J.		2	1	1										Pilot had just bought plane; forced to land; flying over city; no field; crash
84	Sept. 4	Anahaim, Cal.			1											Probably poor field and bad judgment
85	Sept. 4	Athens, Ore.			1	1										Oil lead breaks, forcing landing; no routes for inter-city flier
86	Sept. 4	San Francisco, Cal.			1			1								Spectator runs in front of plane landing; pilot wrecks it to save life

TABLE NO. III — Continued

Num- ber	Date	Locality	Killed	Injured	Causes								Remarks			
					Pilot	Field	Lack of Weather Data	Lack of Route Data or Flying Rules	Really Craft	Really Engine	Really Accessory	Stunting		Collision in Air	Carelessness on Field	Unknown
87	Sept. 6	Flint, Mich.....										1				Girl doing "dance of death" on plane at night, slips, but pilot maneuvers plane to save her
88	Sept. 7	Summumount, N. M.....										1				Stunt flier runs out of gasoline at low altitude
89	Sept. 7	Norfolk, Va.....										1				Girl stunt flier falls into creek
90	Sept. 7	Monmouth, Ill.....										1				Old machine crumples in air, killing pilot; lack of inspection
91	Sept. 8	Santa Fe, N. M.....														Three nearly killed when pilot forgets to fill fuel tank
92	Sept. 11	Jefferson Heights, Ill.....														Oil lead breaks, blinding pilot, forced landing; plane wrecked
93	Sept. 12	Croton, N. Y.....									1					Probably lack of inspection; engine trouble compels seaplane with 9 on board to make forced landing
94	Sept. 24	Bemidji, Minn.....		2	1											Pilot stunting when crash occurs
95	Sept. 24	Uniontown, Pa.....										1				Stunt flier kills engine few feet over racing motor car and crashes
96	Sept. 24	Oklahoma City, Okla.....	1		1											Stunt flier killed trying to change planes in air
97	Sept. 29	Kamiah, Ida.....		1	2	1						1		1		Stunt flier strikes high voltage wires
98	Oct. 5	Farley, Ia.....														Planes collide on landing
99	Oct. 6	South Bend, Wash.....														"Home-made" seaplane crashes into river; lack of examination and inspection
100	Oct. 12	Pinole, Cal.....		3												Cows turned into landing field, so plane crashes into backyard
101	Oct. 14	Revere, Mass.....		2												Plane collapses while stunting
102	Oct. 23	Boise, Ida.....										1				Improperly adjusted propeller causes crash in take-off
103	Oct. 24	Long Branch, N. J.....	1													Girl stunt flier dies trying to leap from motor car to plane
104	Oct. 30	Philadelphia, Pa.....	1	1				1								Instruction airplane flies over congested area; has forced landing
105	Oct. 30	Ft. Dodge, Ia.....							1							Inter-city fliers have no route guide; probably lack of inspection
106	Nov. 4	Omaha, Neb.....	1													Parachute jumper drowned
107	Nov. 6	Omaha, Neb.....		5	1											Probably bad take-off
108	Nov. 11	San Francisco, Cal.....		2	1											Poor judgment in take-off
109	Nov. 18	Haddam Neck, Conn.....	1	2				1								Lack of weather and route data; seaplane hits tree in fog
110	Nov. 20	Seattle, Wash.....	1					1								Lack of weather reports; seaplane flies into blinding snow storm and is wrecked
111	Nov. 22	Spokane, Wash.....		1											1	Mechanic breaks arm cranking engine; plane used as ambulance
112	Nov. 27	Los Angeles, Cal.....	1													Racing at very low altitude
113	Nov. 30	San Diego, Cal.....				1										Field near bay; bad take-off; plane plunges into water
114	Dec. 4	San Francisco, Cal.....	1													Parachute jumper loses grip

Notes—

- Mar. 2 Pensacola, Fla.
Navy Seaplane side-slipped to
beach, killed 5 bathers.
- May 28 Army Ambulance Plane crashed
at Morgantown, Md.; 7 killed.

RECAPITULATION—

114 Accidents	2
49 Fatalities	1
89 Injuries	2
	6
	16
	13
	13
	28
	16
	8
	8
	1
	114

due to	49
Piloting	20
Poor Fields or Lack of Them	4
Lack of Weather Data	10
Lack of Route Data or Flying Limitations	4
Inspection { Faulty Craft	9
{ Faulty Engine	9
{ Faulty Accessory	29
Stunting	2
Collision in Air	8
Carelessness on Field	2
Unknown	8

STATES—

EASTERN:	
Alabama	1
Connecticut	1
District of Columbia	1
Florida	1
Georgia	1
Massachusetts	2
New Jersey	10
New York	7
Pennsylvania	4
Virginia	2
	30

MIDDLE WESTERN:

Colorado	1
Illinois	9
Indiana	2
Iowa	7
Kentucky	1
Louisiana	1
Michigan	3
Minnesota	5
Nebraska	4
Ohio	1
Oklahoma	2
Tennessee	1
Texas	2
Wisconsin	4
	43

FAR WESTERN:

Arizona	1
California	15
Idaho	5
Montana	5
New Mexico	2
Oregon	4
Washington	9
	41
	114

LACK OF WEATHER REPORTS

"While only 4 accidents are attributed to the lack of weather reports and 10 to the lack of clearly defined routes or limitations in traveling between or over cities, it is certain that aerial transport cannot develop until these factors are met. As an illustration—two of the worst accidents in our flying history are attributed to these causes. As one was Naval and the other Military, they cannot be included in the civil table, though in their results they were as harmful to civil flying prospects as though they had occurred to private individuals.

"On March 2, a Naval seaplane, according to press reports, sideslipped on to a beach near Pensacola, Fla., and killed five bathers. Either the seaplane had no business over that beach or the bathers had no business on it. In either event, the fatalities would have been prevented had proper authority existed.

"On May 28 a large Army plane crashed at Morgantown, Md., killing its seven occupants, who included some of the best-known figures in Military and civil aviation. According to the report of the Inspector General's investigators, the disaster was not due to defects in the machine or to incompetence on the part of the pilot, but to the terrific storm into which the ship flew and of which the pilot had not been warned. The investigators above referred to recommended that 'steps should be taken to install a system for interchange of weather conditions and weather forecast between flying fields maintained by the various services, including Army, Navy, Mail Service and Coast Guard Service.' It was further stated: 'Obtaining information of weather conditions on a cross-country flight ranks in importance with the inspection of the engine and plane, and it is highly desirable that, in peace times, except in emergencies, no cross-country flights should be undertaken until available information of conditions on the way has been obtained.'

"Commercial cross-country or inter-city flights, it is evident, cannot be encouraged with safety until there is full protection afforded by establishing civil weather reports and coördinating these with the various Government reports. This service obviously, cannot be provided by the several States.

INSPECTION AN IMPERATIVE NEED

"Equal in importance with learning the qualifications of pilot and navigator is inspection of aircraft and engines. Out of the 114 accidents, 22 may be attributed to faults which proper inspection probably would have revealed—4 concerning the plane, 9 the engine and 9 an accessory, gas or oil. This inspection must be made at frequent intervals by Federal authority.

"When it is remembered that operators of motor cars are required to qualify and that motor cars are periodically placed under rigid inspection, it is astonishing to learn that *any one* can take *any* sort of flying machine into the air at the present time, with the consequent peril not only to himself and his passengers, but to many persons on the ground. If the standard of control were left to the various states, the hope of correcting this unfortunate condition would seem remote.

"In one accident attributed to the attempt of the pilot to stunt an unsafe machine, two lives were lost. An investigator reported that the plane was not a factory-maintained product. He said: 'It was one of the Army training types which had passed through many owners and which, my investigation shows, had been in at least four crashes previous to the final one. I found

that the machine had been repaired by amateurs, that several of the spars and longerons were patched, some of them in four places. It was the giving way of these spars that undoubtedly caused the wings to collapse. The plane had lain out of doors in the open field all winter and one windstorm had blown it the full length of the field—about 1000 yards—and turned it over end. This spring it had been hauled back to its original position and put together again as best as might be. It was never inspected by a competent person, so far as I was able to learn. I found that the owner of the flying field—who is also a flier—had himself refused to fly this machine when the young man who took it up on its fatal trip was induced to become the pilot.'

"In the lack of any Governmental examination and inspection, the legitimate manufacturers and operators have endeavored to do what they could. They check up on their products, but their control is of necessity limited to localities and to a comparatively brief period of time. As flying increases, this method must become more hopeless and a stern responsibility is thus placed upon the Federal Government to provide an adequate system of examination and inspection.

STUNTING CAUSES MORE THAN 40% OF DEATHS AND INJURIES

"Twenty-nine of the 114 accidents occurred during stunting. In these 29 accidents, 20 persons were killed and 36 injured—more than 40% of the total. In other words, stunt flying in unrestricted areas was responsible for almost as many casualties as all other elements combined. Now stunt flying is necessary to testing and essential to warfare. It is believed advisable that all pilots know *how* to stunt so that, in case of an emergency, when *only* a stunt will save their craft, they will be able to act quickly, with understanding and without fear. But the habit of stunting for thrill is dangerous, fatal in many instances, and always harmful to civil flying. A governmental system of control, limiting stunting to certain areas will meet this unfortunate menace to aeronautics. In this connection, however, there is hope of general improvement. State Fairs and other amusements, since the war, have encouraged dare-devil flying as 'concessions.' But after stunts had killed many people and injured more under spectacular circumstances (such as collisions with grandstands, crashes on beaches, etc.) the New York State Fair Commission, according to press reports, eliminated the dare-devil aerial acrobat from its list of attractions.

COLLISION IN THE AIR

"The danger of collision in the air is not great, providing levels of flight for aircraft under way are established and observed, and providing stunting is controlled. The 2 collisions reported occurred during stunt performances. In the first, one man was killed, and in the second, 2 were killed and one hurt.

CROWDS SURGE ON TO FIELD

"Eight accidents causing injury to 7 persons are reported through carelessness on the field. In several notable instances the pilot, in order to avoid the crowd which surged out in front of his machine as he was taking off or

landing, deliberately wrecked his craft. It is observed that at every flying demonstration, even at locally policed fields, the spectators ignore warnings and must be forced to keep back. This is illustrated by the long list of automobile race track casualties, where spectators get in the way. Only Federal rules rigidly enforced are able to meet this condition.

SEARCHING FOR THE "UNKNOWN" CAUSE

"Finally, 8 accidents which caused death to 4 and injury to one are attributed to "unknown" causes. The hope of preventing accidents depends on learning—then correcting—the cause of each. It is evident that Federal authority is required to obtain information in such cases.

FLYING NOT UNSAFE

"From the foregoing it is seen that flying, even with the burden of unnecessary hazard imposed through the lack of an Aerial Code, is not unsafe.

"Eliminating those deaths caused by stunt flying (20) and those attributed to lack of fields, weather reports and clearly defined air lanes or routes (6) which only Federal authority can correct—23 fatalities remain—or one to about every 12,000 passengers and one to 282,608 miles of travel,—unlicensed, unregulated and uncontrolled, and carried on for the most part in former war machines built from three to four years ago.

"In the case of the 125 operating companies, which flew 2,907,245 miles and carried 122,512 passengers on 130,736 flights, not a single fatality occurred in straight commercial activity. And it is from this record rather than from the itinerant picture that the public should judge the safety of travel by air. These companies approximate the condition in equipment and personnel which will be general when the Federal Government recognizes its duty and responsibility.

"Furthermore, the airplane of 1921, powerful and beautiful as it appeared to us, and as it undoubtedly was in contrast with the gliders of Lilienthal and Chanute and even the Kitty Hawk biplane of the Wrights, will some day be to the ultimate flying machine what the primitive train of 1830 is to the Twentieth Century Limited.

"The designing and engineering features are progressing. Improvements in safety and efficiency are being constantly introduced. These, if aided by regulation and stimulation by the Government, assure security in the air travel of the near future comparable with that of the accepted means of transportation which we have today on rail, road and water."



Secretary of War Weeks (in civilian clothes) and Generals Pershing and Mitchell (second and third from right) at Langley Field.
The airplane is a Martin Bomber, the type which sank the warships.—Photos, U. S. Air Service.



Naval F-5-L's bombing the ex-German submarine "U-117".—Photo, Naval Bureau of Aeronautics.

CHAPTER III

THE AIR DEMONSTRATES ITS COMMAND OF THE SEA—THE BATTLESHIP BOMBING AND THE CONFERENCE ON THE LIMITATION OF ARMAMENT

THE Conference on the Limitation of Armament, which was held in Washington on invitation of the President of the United States, Nov. 12, 1921–Feb. 6, 1922, was the most profoundly significant gathering the world had witnessed since the Peace Treaty was signed at Versailles, and far surpassing even the Treaty in its certain effect upon the future peace of the nations.

At this Conference the first definite, practical steps were taken to release the great Powers of the world from the bondage of competitive armament, which had not spared them the worst conflict in history, and which in 1921 threatened economic ruin.

The immediate net results of this Conference were the scrapping of sixty-eight capital ships, built or building, in the navies of the United States, Great Britain and Japan, representing a gross tonnage of 1,876,423, and, with limitation on construction in these countries and in France and Italy as well, assuring a saving of many billions of dollars.

In designating type and tonnage of new construction permissible, the Conference approved the development of auxiliary units for aircraft. To the United States and Great Britain were allotted 5 aircraft carriers, with a total tonnage for each nation of 135,000; to Japan and France, 3 each, with 81,000 and 60,000 tonnage, respectively; and 2 to Italy, with a tonnage of 54,000.

NO LIMITATION ON AIRCRAFT

But what this Conference refused to do was as remarkable, and as indicative of the future, as that which it acquiesced in doing. On Jan. 9, formal debate on the report of the Committee on Aircraft was opened. The Committee, consisting of Rear Admiral William A. Moffett, Director of the Naval Air Service (Chairman), and Brigadier General William Mitchell, Assistant Chief of the Army Air Service,¹ representing the United States; Air Vice Marshal

¹When General Mitchell went abroad, Major General Mason M. Patrick, Chief of the Air Service, became a member of the committee.

J. F. A. Higgins, representing the British Empire; Captain Albert Roper, representing France; Colonel Riccordero Moizo, representing Italy; and Captain Osami Nagano, Japan, had worked for many weeks assembling data through which to ascertain the influence which aircraft would have upon the future and to determine thereby what limitation, if any, should be imposed upon this new arm.

On the reading of this report (see Appendix), all the delegations, in turn, expressed the view that the experts were right in their belief that aircraft limitation was impossible at present. Chairman Hughes expressed disappointment that the Conference was unable to suggest practical limitations on the building of military aircraft, probably the most formidable weapon of the future. The experts had well presented the difficulties. They were dealing with facilities needed in peaceful development. No ban could be put on progress. The question, Secretary Hughes said, resolved itself, not into a limitation of armament, but into a limitation of civil progress, and therefore there seemed to be nothing to do but to accept the experts' report. The report was then formally accepted. Secretary Hughes asked discussion on lighter-than-aircraft, which the experts had said might be limited. As none of the delegations wished to urge action along this line, Mr. Hughes proposed the following resolution, covering aircraft in general:

"The Committee is of the opinion that it is not at present practicable to impose any effective limitations upon the numbers or characteristics of aircraft, either commercial or military."

The resolution was unanimously adopted.

The Conference on the Limitation of Armament, which was thus brought to a successful conclusion, was inspired by two universal desires: First, removal of some of the obvious provocations for war (the fear of a rival nation's rising military power); second, relief from the financial burden of competitive armament and diversion of this money into economic channels.

The problem was to attain both objectives, yet retain an adequate sense of security. The solution came through aircraft, which have demonstrated themselves to be both vehicles of peace and instruments of war, and it came about in this way.

BOMBING THE OLD "INDIANA"

In the middle of October, 1920, Naval seaplanes dropped bombs on the old battleship "*Indiana*," in Chesapeake Bay. Other bombs were placed upon the deck, and the effect of the explosions noted.

Shortly thereafter, Army bombers operating from Langley Field

utilized the hulk of the "*San Marcos*" (formerly the "*Texas*") as a target.

Little attention was paid at the time to either incident, and Captain W. D. Leahy, Director of Naval Gunnery, in an official report to the Secretary of the Navy, observed: "The entire experiment (with the "*Indiana*") pointed to the improbability of a modern battleship being either destroyed or completely put out of action by aerial bombs."

In January, 1921, General Mitchell appeared before the House Appropriations Committee and expressed the opinion that the battleship (the modern type of which costs \$40,000,000) was as obsolete under aerial attack as the "plumed knight in armor" when gunpowder was introduced. The Army Air Service was asking for an appropriation of \$60,000,000, or the equivalent of one and one-half battleships.

AIRCRAFT VERSUS BATTLESHIPS

Thereupon a discussion developed, which has been erroneously represented as a personal controversy, but which in reality was nothing but the concentrated expression of an economic question which had been pressing for consideration in our Congress and also in the parliaments of other nations. The war was over but the debts remained. There was no further immediate need for armament, yet armament costs were mounting. Appropriation demands upon the Treasury, inevitable during readjustment, were increasing, yet commerce and industry presented diminishing returns.

The discussion was carried on principally in Congress. In 1916, a year before we entered the war with Germany, the General Board of the Navy laid down a building program, calling for sixteen capital ships and involving an expenditure of approximately \$640,000,000. In 1919, the General Board reaffirmed the 1916 program, and the year following the Secretary of the Navy indorsed its views. It was this program which was urged upon Congress early in 1921.

The press of the country, sympathetic to anything which offered the hope for economy, and alive to the possibilities of a spectacular demonstration of the relative superiority of aircraft over surface ships, urged that the airmen be given an opportunity to put their beliefs to the test.

Accordingly, on Feb. 7, Secretary Daniels wrote Secretary Baker, stating that the Navy contemplated certain experiments involving aircraft and bombs and inviting joint control by the Army and the Navy. This offer was accepted and representative flying officers of both services were assigned the task of working out the details.

For the next three months intensive training was carried on by the naval and military aviators. There was keen rivalry and common interest. If there was any tinge of conflict, it was not among the airmen, but between the airmen of both services as a unit and the advocates of the capital ship as the "backbone of the fleet." The greatest aerial activity the country had noted since the war was carried on at the Army base at Langley Field, Hampton, Va., and the Naval base at Hampton Roads. Personnel in both services from stations near and remote asked permission to participate, and when Mr. Daniels, to show his confidence in the ability of the capital ship to withstand assault from the air, offered to navigate the bombed craft himself, Army fliers by the score begged for the privilege of attacking under actual fire.

THE STAGE IS SET

Such was the spirit which animated the scene that appeared on the morning of June 21, when a magnificent gallery of capital ships from the Atlantic fleet, destroyers, mine sweepers and other units, assembled nearly a hundred miles off the Virginia Capes to witness the first experiment.

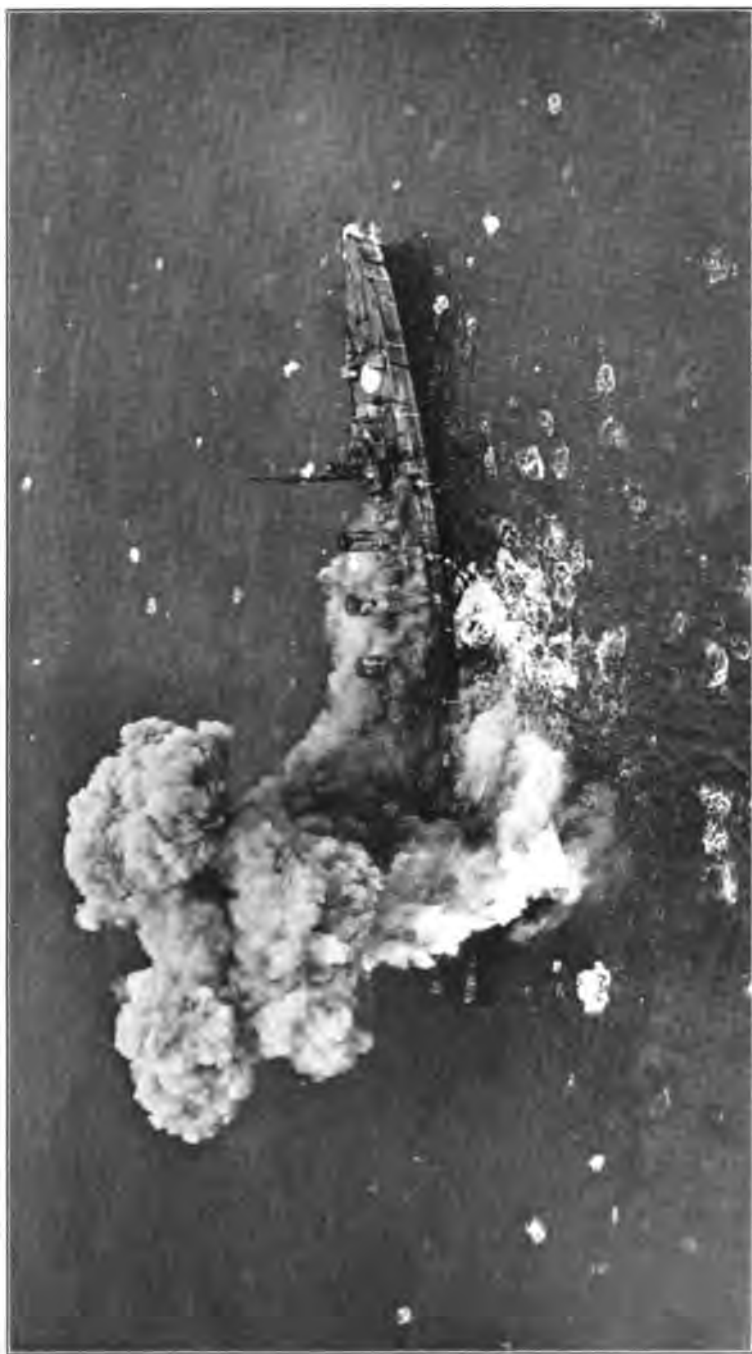
It was truly a historic occasion. The Naval transport "*Henderson*" had sailed from the Washington Navy Yard the day before with high Army and Navy officers, members of Congress, foreign diplomatic representatives, and half a hundred newspaper correspondents and photographers. The gathering in the ward room of the "*Henderson*" on the night of June 20 was tense and dramatic. There was much conversation about many topics, but little about the only one that amounted to anything: "Was tomorrow to mark a turning point in the warfare of the future?" Two remarks, both by non-aviation Naval officers, were typical. The ex-German submarine *U.-117* was to be attacked on the morrow. A submarine officer expressed the willingness to command his craft in its stead. But another officer said: "Tomorrow we'll see whether we sink or float."

When the remnants of the German imperial fleet were distributed among the victors, certain submarines, among them the *U.-117*, which, a few years before, had sunk shipping along the American Atlantic coast; a destroyer, the *G.-102*; a light cruiser, the "*Frankfurt*," and a dreadnought of the latest type, the "*Ostfriesland*," fell to the lot of the United States, and these craft were selected as the targets.

It was typical of the Navy that, on an occasion, the outcome of which if successful might mark a new epoch in sea warfare, Naval aviators and Naval seaplanes should be chosen for the first demon-



Sinking of the ex-German destroyer "G-102".—Photo, Naval Bureau of Aeronautics.



Army bombers score hits on ex-German cruiser "*Frankfurt*." —Photo, Naval Bureau of Aeronautics.

stration. If the air *did* command the sea, the Navy would be the first to acknowledge it, and to the Navy that floats add the Navy that flies.

U.-BOAT SUNK IN 16 MINUTES

It was all over so quickly that it was hard to conceive the trick had really been done. The *U.-117* lay awash some 2500 yards from the "*Henderson*." Three F.-5-L's appeared in the morning haze, and, keeping beautiful formation, roared over the submarine at 1100 feet. Twelve 163-pound bombs were dropped—the entire cargo. All registered hits within the danger zone. The first salvo of three bracketed the U.-boat, apparently opening its seams. The next salvo of nine bombs literally smothered the craft. At least one of these fell amidships and broke its back. Possibly three bombs hit the submarine direct. In seven minutes after the second salvo, and sixteen minutes after the first bomb was dropped, the *U.-117* lay on the bottom of the Atlantic.

While efforts had been made by higher officers of both services to lighten the impression that the demonstrations were in the nature of a test, this, nevertheless, was the conviction of the press, and the rapid sinking of the submarine provided the correspondents with proof that aircraft were effective. Congressmen on board the "*Henderson*," who had hitherto been stanch supporters of the capital ship to the possible exclusion of other types, saw in the sinking of the U.-boat the necessity for a three-plane Navy, below the surface, on the surface, and in the air.

SEARCH FOR THE "IOWA"

The next phase was not presented until June 29, when the old U. S. S. "*Iowa*," under radio control, was utilized, first in a search problem and later in bombing. In this event, too, only Navy and Marine Corps craft participated. The scene was ninety miles northeast of Cape Henry. Planes were dispatched from stations at Cape Henlopen, Cape Charles, Cape Henry and Cape Hatteras. In 1 hour and 57 minutes after warning had been given of "enemy" approach, the airplanes and seaplanes had located the "*Iowa*," after having flown one hundred miles to sea from their base. The "*Iowa*" was in a 25,000 square mile area, and this area had to be searched, before contact could be established.

The Navy did not want to injure the "*Iowa*," so only concrete or dummy bombs were used in the attack. Altogether 80 were dropped, ranging in weight from 163 to 520 pounds, from 4000-foot altitude, and only two hits were reported, although twenty-five planes partici-

pated. During the attack, the "*Iowa*" was navigated slowly by radio in a zigzag course. Whether it was the motion or whether it was the known fact that dummy bombs cannot be "aimed" because they hurtle over and over in their descent that accounted for the apparent failure, was debated, pro and con, according to the point of view being marine or aeronautical. But even so, 50% of the dummies fell within the danger zone.

The press, to which competition is ever a delight, saw in the "*Iowa*" test a setback to the hopes of those advocates of aviation who sought complete dominion. And truly it so seemed. But there were other incidents to come.

WAR TACTICS SIMULATED

It is not within the province of this Year Book to discuss the rules under which the bombing tests were conducted, but it is true that, not until July 13 when the *G.-102* was brought out for attack, was the Army Air Service able to simulate actual war tactics. General Mitchell appeared in his own machine and personally directed his fliers. The primary attack was made at 200 feet with eleven S.E.-5 pursuit land planes, dropping a total of forty-four 25-pound fragmentation bombs, as officially explained, "to clear the decks, disrupt morale and put the anti-aircraft guns out of commission." Fifty-seven % of these bombs registered hits.

Twenty-eight Martin bombers, carrying 300-pound demolition bombs, then appeared. Nineteen minutes after the first of these heavy charges was dropped from a height of 1500 feet the destroyer sank. Direct hits could not be accurately counted, so rapidly were the missiles released. The final plunge of the doomed ship occurred in two minutes.

BOMBING THE "FRANKFURT"

But the submarine was a shell, and the destroyer little more, it was said. What could be done with the "*Frankfurt*," a light cruiser? The test, on July 18, was in two phases, at 1000 to 1500 feet altitude. In the first, which lasted from 9:27 a.m. to 1:56 p.m., Navy and Army bombers joined in dropping fifty-four 250 and 300-pound bombs. But these did little damage, and up to the time the second phase began it seemed that victory in the air was hopeless. Plans, indeed, were actually under way to sink the cruiser by gunfire, and to place time bombs on board to insure destruction.

UNDERWATER BOMB FATAL

The second phase, with 520 to 600-pound bombs, began by a Naval attack at 2:28 p.m. Out of ten dropped, two hits were recorded, but it was evident that the cruiser was not sinking. At 4:15, a fresh division of three Army Martin bombers from Langley Field, which had been circling overhead for nearly an hour, awaiting orders, received permission to attack. Thirty-five minutes later, after dropping eleven bombs, three of which broke her back, the "*Frankfurt*" sank. One of the three exploded in the water close to the hull and it was believed that it was this explosion that did the worst damage, thus demonstrating a theory, hitherto rejected by many, but which, in the final test with the "*Ostfriesland*," was to be completely established.

SINKING THE "OSTFRIESLAND"

The last and most remarkable of the series was the assault on the "*Ostfriesland*," a huge, powerful dreadnought, 22,800 tons displacement, and one of the main ships in the German fleet at the Battle of Jutland. Here was a floating fortress, with heavy steel walls built to withstand the mightiest gun projectiles.

The first day, July 20, operations were confined to small bombs. Five Marine DeHavillands, four Army Martin Bombers and eleven Navy F.-5-L's showered fifty-three 230 to 520- and 600-pound bombs, at heights of 1000 to 1600 feet, but with no apparent vital damage. Of the ten direct hits, nine bombs failed to explode. Some of the shots were spectacular, immense sheets of flame enveloping portions of the ship—but the fighting parts remained little harmed. These operations, which were begun late, occupied the entire day, and by nightfall predictions of failure were to be heard more frequently than expectations of success. In fact, then, as throughout the demonstration, the tenor of the conversation among most of those aboard the "*Henderson*" was skeptical as to the ability of aircraft to justify all that had been claimed for them.

SMALL BOMBS OPEN SEAMS

But the tale was abruptly and vividly ended the following day. The Board of Observers, which, on the 20th, could find no real damage to the vital parts of the "*Ostfriesland*," discovered that some of her seams had been opened and that during the night she had gone down two feet by the stern. The rules limited the number of

direct hits which it was permissible to make, but in the operations the second day it became evident that the Army was deliberately seeking not to make direct hits, but to drop the bombs in the water close to the site of the warship.

At first 1000-pound bombs were used, five Army machines dropping one each. There were three direct hits, and at each charge the huge fighting vessel quivered and pitched under the shock.

DREADNOUGHT GOES DOWN IN 21½ MINUTES

In the next phase, when 2000-pound bombs were employed at 2000 to 2500 feet, it was clear that General Mitchell did not seek direct hits. A blow on deck was spectacular and might be dangerous. An explosion close to the hull, with the uncompressible mass of the ocean behind it, meant more.

In this final phase seven Army bombers participated, each carrying one bomb. Four bombs were purposely placed in the water close to the dreadnought. A fifth exploded, on deck, and another fell 300 feet in advance. Of the four close up, one detonated on the port side of the quarter-deck and another close in on the port side of the stern. The shocks were distinctly felt on the "*Henderson*," more than three miles distant. The "*Ostfriesland*" pitched, was deluged with tons of water, and almost immediately began to sink by the stern. Her bow reared out of the sea, she rolled over and, 21½ minutes after the first 2000-pound bomb was dropped, she took her final plunge.

It was a sight to thrill and sportsmanship in both services sent forth cheer and applause to the fliers, as the seventh bomber, arriving just as the ship went under, dropped its TNT into the foaming, eddying vortex.

"BOMB HEARD ROUND THE WORLD"

Among those on board the "*Henderson*" was General Williams, Army Chief of Ordnance. "A bomb was fired today," said he, "that will be heard around the world."

Major General Charles T. Menoher, who at that time was Chief of the Air Service, said: "A cold material fact has been demonstrated. The fact is that the battleship can be sunk by the aerial bomb."

Rear Admiral Moffett said: "We must put planes on battleships and get aircraft carriers quickly. That is now the great need. We must now get them and quickly. We must put aviators on all

our battleships to enable them to ward off air bombing attacks in the event of war, pending the time we get airplane carriers."

The effect of the sinking of the "*Ostfriesland*" was to establish definitely in the public mind (which means in the mind of Congress) the conviction that aircraft, representing a total investment, including armament, of a quarter of a million dollars, could destroy the hitherto unconquerable dreadnought costing \$40,000,000. It carried the conviction that the nation controlling the air commanded also the water beneath.

A Joint Board representing the Army and the Navy was appointed to review the results of the tests. The Board, on August 18, officially reported:

"The aviation and ordnance experiments conducted with the ex-German vessels as targets have proved that it has become imperative as a matter of national defense to provide for the maximum possible development of aviation in both the Army and the Navy. They have proved also the necessity for aircraft carriers of the maximum size and speed to supply our fleet with the offensive and defensive power which aircraft provide, within their radius of action, as an effective adjunct of the fleet. It is likewise essential that effective anti-aircraft armament be developed."

EFFECTS DEBATED IN CONGRESS

In the meantime, the many Senators and Representatives who were aboard the "*Henderson*," on the various trips, carried back to Congress first-hand accounts of the bombing. Other members who were not witnesses, but who were equally keen, obtained from the press enthusiastic reports and vivid pictures, especially of the sinking of the "*Ostfriesland*."

The military and naval appropriations were under protracted consideration. There was great unwillingness to spend money for armament under scrutiny as obsolescent, and the Naval bill in consequence was subjected to the severest criticism. Parallel with this, there ran the discussion of world peace and reduction in the non-productive military and naval establishments of the larger powers. Senator Borah, with more persistence than tact, kept calling for a naval holiday and insistently urged that some attempt be made to get the major nations to agree to a limitation of armament.

Early in August, Senators Borah, Nicholson, King, Stanley, and Jones of Washington, participated in a debate on the bombing trials. Extracts from their remarks, as taken from the *Congressional Record* of Aug. 5, pp. 5051-5054, are as follows:

SENATOR BORAH: "We are expending now about \$400,000,000 upon the Navy, and since the experiment off the Virginia coast I have been convinced

that we are expending at least \$240,000,000 of it in a way that will not add any security to the people of the United States. The experiment off the Virginia coast demonstrated that which the best minds in the naval life of England have asserted for the last year and a half, that the battleship is practically obsolete. . . . We are building sixteen battleships, costing from \$40,000,000 to \$42,000,000 apiece, and in less than thirty minutes, as General Mitchell told us he would, they sunk the ship which von Tirpitz said was an unsinkable ship. Yet the airplane development is just beginning. It is just in its youth. Nay, more, it has not accomplished anything compared with what it will accomplish, according to those who are informed, even within the next year. Yet we go forward building these great battleships at this enormous expense, knowing that inside of two years the airplane will have rendered this particular type of battleship absolutely worthless as a defensive proposition. . . .

LEARN LESSON AND SAVE MILLIONS

"Mr. President, there are six of those great battleships of the *'Indiana'* class, costing \$40,000,000 to \$42,000,000 apiece to build, upon which very little work has been done, upon which a very small percentage of building has been accomplished, and if we want to save, would it not be wise to discontinue the building of those six battleships of the *'Indiana'* type; not only to slow down, as I understand the order has already been given—not only to slow down, but to abandon and clean up the contracts? If it costs us \$10,000,000 to clean up the contract, very well and good; we will have saved \$230,000,000 or more by doing that. If it costs us \$40,000,000 or \$50,000,000, we will have saved \$200,000,000 or more by doing so, and in my opinion, unless we are willing to do that, Mr. President, unless we are willing to cut the Army to 100,000 men and reorganize the official organization of the Army, and unless we are willing to take the lesson which we have had given to us off the Virginia coast, and discontinue the building of at least six or eight of these battleships, there is no place where we can cut any expenditures that will amount to anything considerable."

SENATOR JONES: "Mr. President, I had the privilege of seeing the bombing of that German battleship, and I heard some of the expert naval officers talking with reference to that ship and the character of its construction before it was sunk, and one of them said that, in his judgment, it was a thousand to one that the ship would not be sunk by the bombing. He was thoroughly acquainted with the character of the construction, with the water-tight compartments, and all that sort of thing; and yet, as the Senator from Idaho has said, within fifteen or twenty minutes from the dropping of the first 2,000-pound bomb the ship was sunk."

WASTE OF MONEY TO CONTINUE BUILDING BATTLESHIPS

SENATOR BORAH: "Mr. President, without assuming to say that the battleship is absolutely obsolete and can never be made effective by any changes which may be made or any different construction which may be had, it does seem to me conclusively established that to go forward and build these battleships at this time until this testing proposition has been carried to its final conclusion, until we know what is needed, what kind of battleship will stand it, is a mere waste of money. No man in the Senate, as a



Ex-German dreadnought "*Ostfriesland*" before the attack.—Photo, U. S. Air Service.



Army Bomber drops 2,000-lb. TNT bomb under stern of "*Ostfricsland*".—Photo, U. S. Air Service

business man, a member of a corporation, a stockholder, or having anything to say with reference to the expenditure of his money upon that kind of an enterprise, would consent to it for a moment. He would say, 'Let us know whether we are putting \$42,000,000 into each one of these ships that can be sunk in twenty-one minutes before the aircraft service has even reached what it contends is its first period of success in these matters.'

SENATOR NICHOLSON: "Under the Senator's reasoning would it ever be possible to land an army on foreign soil, provided that the Nation spent sufficient money to have airplanes capable of carrying the bombs of which the Senator speaks?"

SENATOR BORAH: "The Senator has suggested a very important proposition. An admiral stated to me a few days ago that not only the experiment off the Virginia coast demonstrated that the battleship as it is now being built is practically obsolete, but it demonstrated further that with sufficient airplane and submarine protection, this country was perfectly safe from attack from any other country."

DESTROY TROOPSHIPS FROM AIR

SENATOR JONES: "This shows, too, that while possibly the airplane would not do vital damage to a battleship by striking it on the deck, yet it would absolutely destroy transports carrying troops."

SENATOR BORAH: "Yes. Of course Mr. President, it might be inferred from something I have said that I would like to see our naval building stop entirely, regardless of what other nations do. I do not take that position. I do not wish that to be understood. What I say is that we are putting this vast amount of money into these ships without getting any corresponding security and without getting any safety such as we are entitled to have for that amount of money. We had infinitely better take \$40,000,000 out of these battleship expenditures and put it into airplanes and submarines if we want real security and real safety. I do not think in the building of battleships we are giving our country any security or any safety at all, comparatively speaking."

SENATOR KING: "I think those tests demonstrated the vulnerability of the battleship, and demonstrated that, while it is not obsolete, as the principal unit of the fleet, its strength and influence have been greatly impaired."

NATIONS IN AGONY OF WANT

SENATOR STANLEY: "I hope the Senator from Idaho will understand that I am in complete and ardent harmony with him as to the vital importance of the matter to which he calls the attention of the Senate and the country. The nations of the world, as the Senator from Idaho has so much better said than could I, are in an agony of oppression and want. The necessities of the people and the demands of the Governments have ground the taxpayers to the bone."

SENATOR BORAH: "Mr. President, the party which is now in power cannot afford from any standpoint to permit any opportunity to go by to reduce expenses to the point where at least we shall not have to increase taxes; it will be unfortunate if taxes must be maintained even at the present rate. I hope, therefore, when the resolution which I have offered goes to the committee we may have an immediate consideration of it and an immediate report

on it. It ought not to require long to consider the resolution. The whole matter was discussed a few weeks ago in this Chamber; every Senator's opinion is made up; and if the resolution could be reported and passed and the Army curtailed as it proposes, it would be a vast saving in that particular.

"Then, if the Naval Committee would report out the bill which has been introduced by the able Senator from Utah (Mr. King) to adjust that situation, [Senator King had proposed converting six battle cruisers, under construction, into aircraft carriers, to be equipped with pursuit, bombing and other types of airplanes] we should save an expenditure in that direction of some \$240,000,000, and still have a better Navy than we shall have by the expenditure of that sum. If there is any other way by which we can save, I do not know of it. We may cut out some expenses here and there in a department, or we may dismiss a few employees and curtail here and there in a small way, but we cannot cut down expenses in such manner as the Secretary of the Treasury says we must in order to hold taxes even to the present status unless we do it upon these two lines."

TESTS WITH "ALABAMA"

The Army Air Service on Sept. 23, 24 and 26 conducted a series of chemical, smoke and explosive bombing tests by day and by night on the old battleship "*Alabama*," which had been turned over to them by the Navy, but the attacks, although brilliant and spectacular, were in the nature of an anticlimax. Even when, on the 26th, the old ship went down with a mortal wound inflicted by one 2000-pound bomb, the public was little stirred. The "impossible" had already been accomplished, under severer handicaps, in the sinking of the "*Ostfriesland*," and hence it was no longer impossible but commonplace.

NAVY ESTABLISHES AERONAUTICS BUREAU

The Navy in the meantime had steadily, if deliberately, moved toward recasting its structure to accommodate the new weapon from the air. During the war there had been a sort of bureau created by departmental order for the handling of matters aeronautical, but this was dissipated shortly after the signing of the Armistice and aviation suffered badly in consequence.

When the aircraft-battleship discussion was starting, a new Director of Naval Aviation, in the person of Rear Admiral Moffett, was selected. It was Moffett's task to create a distinct Bureau of Aeronautics within the Navy Department, and to arrange for the bombing trials. His was a most difficult position and credit should be in proportion. General Mitchell had at his command personnel and matériel, a recognized organization and, above all, he had the sympathy of his chief. Moffett had no organization and but little equipment. But he had vision and wisdom, which largely explains

the establishment, with the good will of his fellow admirals, whose past and future still lie with the capital ship, of a Bureau of Aeronautics competent and eager to carry out the recommendations of the Joint Board.

Of this Bureau, the Admiral has said:

"The creation of a Bureau of Aeronautics is our first move toward obtaining control of the air, which is necessary if we are to hope successfully to defend ourselves at sea. Without the aviation that it needs, or should have, our fleet is lost if it engages an enemy equal in other respects, and having also an overwhelming advantage in aviation. Without the aviation it should have, the millions invested in the fleet are thrown away, and without it the fleet is in constant danger. Not an instant should be lost in pushing to completion the aviation needs of the fleet; the fleet's very existence depends on aviation. Without aircraft we might as well scrap our dreadnoughts."

GENERAL MITCHELL'S VICTORY

General Mitchell's splendid zeal and courageous devotion to his convictions were universally recognized. The sinking, one after the other, of the various types of modern warcraft was generally regarded as not only a demonstration of magnificent discipline among his men and as vindication of the view that aircraft is the dominant arm of the future, but also as a distinct personal victory. Mitchell had spoken many times with more thought for the truth than for harmony or for his own future and whenever a new idea appears to dispute supremacy with the old, a clash is inevitable. There was a clash, but the new idea and its chief exponent, General Mitchell, remain invulnerable through perfect justification.

Shortly after the bombing, General Menoher retired as Chief of the Air Service and was succeeded by General Patrick, who was Chief of Air Service for the A. E. F. Speaking of the bombing, General Patrick has said:

"Few things which have ever been done have been the cause of more serious thought on the part of military men than the bombing tests, which were carried out in 1921, and of which the results were most remarkable. For the actual initiation and conducting of these tests I give all credit to General Mitchell, whose enthusiasm and whose knowledge of what could be accomplished were well borne out by the results obtained. There was gathered together at Langley Field an Air Service organization which was given thorough training, the men in which worked heart and soul to prepare themselves to show just what could be done, and when the time came for them to act, they did not fail. It was demonstrated beyond a doubt that aircraft were capable of putting out of action, or even of destroying, any surface ship which has yet been designed. Of course, the aircraft were not opposed and it is reasonable to assume that the navies of the world,

aware of the threat to their existence, will bend their utmost efforts to finding some means of meeting this menace, but whatever may be done along this line, the development of military aircraft will likewise progress and it is a conservative statement that aircraft can make our coasts practically immune from attack, either by a naval force or by any expedition which would undertake to land an army anywhere along our extended coastline.

Anti-aircraft guns we do not fear, and I believe it will be physically impossible for an enemy to transport to a point near our coast an air force sufficient to secure that supremacy in the air which would enable him to work his will."

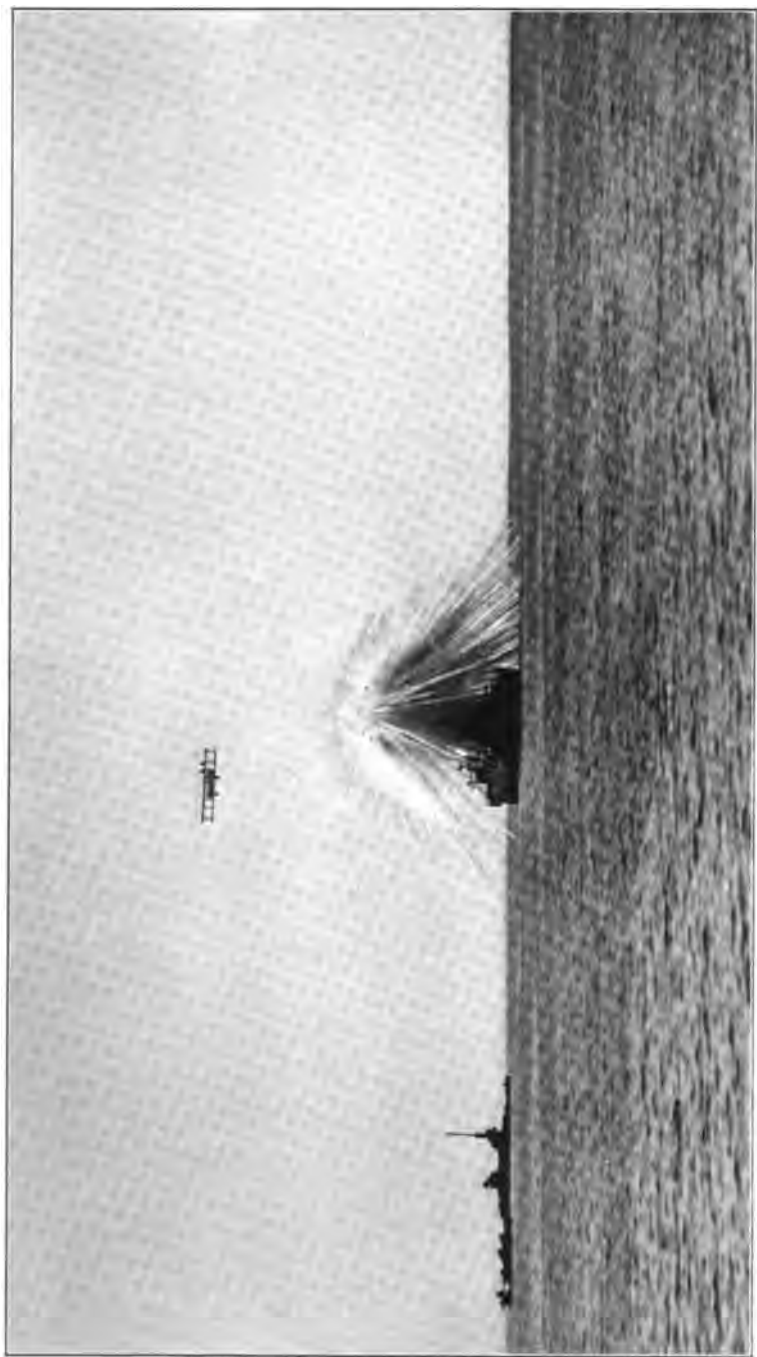
PUBLIC REALIZES SIGNIFICANCE

Thus, among the public, in Congress, and with the Navy and War Departments, there was full realization of what the bombing tests meant.

On Aug. 11, President Harding issued an invitation to the great powers to come to Washington and deliberate means for cutting down the bills for big guns and big ships. The part that aircraft took in initiating this conference is definite. The recognition, in the findings of the Conference, of the significance of aircraft in contributing to our economic welfare while at the same time providing security at minimum cost, is complete.



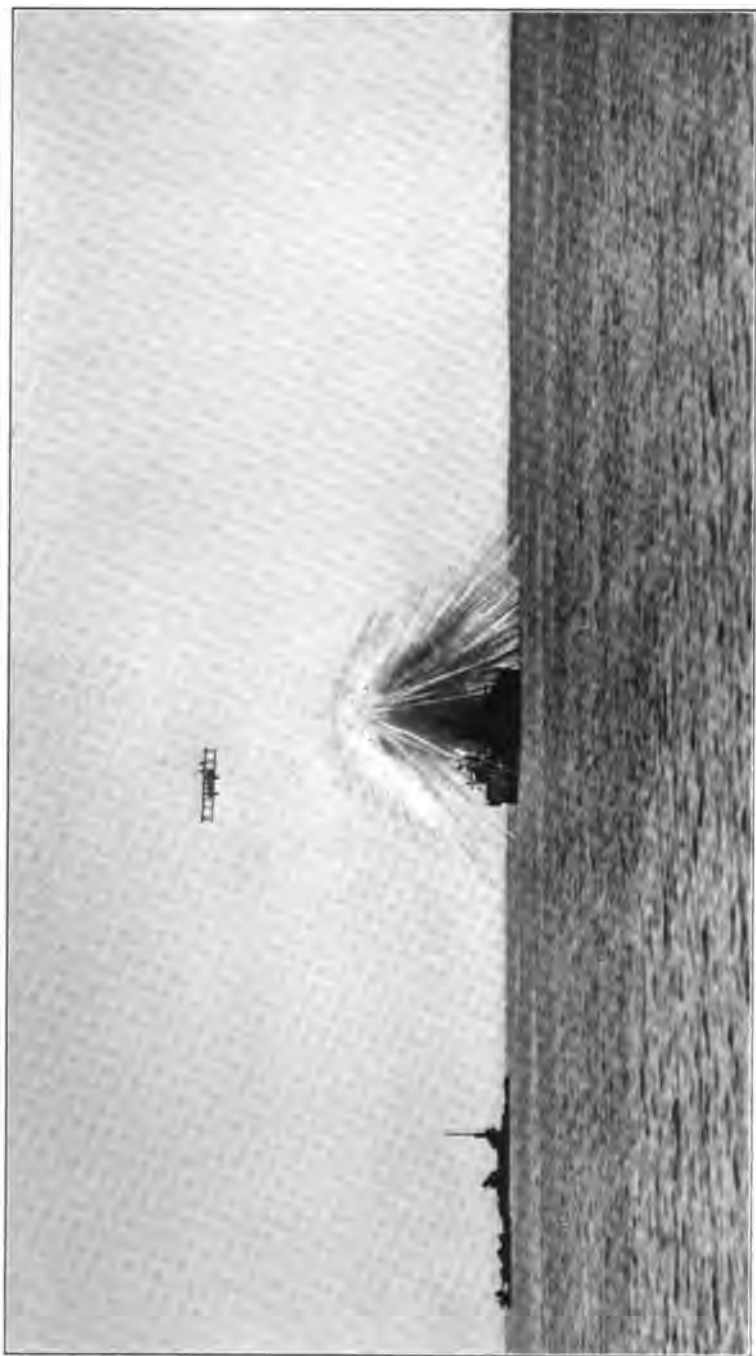
The last of the "*Ostfriesland*," 12:39½ p.m. July 21, 1921.—Photo, U. S. Air Service.



Army Phosphorus bomb hits crow's nest of "*Alabama*."—Photo, U. S. Air Service.

TABLE OF AERIAL BOMBING EXERCISES

<i>Date 1921</i>	<i>Name of Ship</i>	<i>Type</i>	<i>Number of Bombs</i>	<i>Weight of Each Bomb</i>	<i>Number of Planes</i>	<i>Height of Planes</i>	<i>Registered Hits (Di- rect)</i>	<i>Results</i>
June 21	<i>U-117</i>	German Submarine	12	163 lbs.	3 F 5-L Navy Seaplanes	1100 ft.	2 to 4	Sank 16 minutes after first bomb was dropped.
June 29	<i>Ex-Jews</i>	U. S. Battleship (old type)	80 (dummy) 70-163 lb. 10-520 lb.) All dummy (concrete)	163 to 520 lbs.	13 F 5-L's 2 NC's 5 Martins 5 DH's (all Navy and Marine corps)	4000 ft.	2	Proved ability of all kinds of aircraft to fly from land bases, locate and attack ships 100 mi. at sea, locating craft in 25,000 sq mi. area in 1 hr. 57 min. after warning of "enemy" approach.
July 13	<i>G-108</i>	German Destroyer	89 (44-25-lb. Copper bombs 44-300-lb. 1-100-lb.)	25 to 300-lb.	15 Martin Bombers (Army) 14 DH 4B Bombers (Army) 11 SE 5A (Army)	1500 ft. 1500 ft.	32	Sank in 19 minutes after first 300-lb. bomb dropped
July 18	<i>Frankfurt</i>	German Cruiser	75	54-250 and 300 lbs.; 21-520 and 600 lbs.	12 Navy F 5-L Seaplanes 11 Army Martin Bombers 3 Navy Martin Bombers	200 ft. 1000-1500 ft.	11	Sank 35 minutes after first 600-lb. bomb was dropped
July 20	<i>Ostfriesland</i>	German Dreadnought	53	230-520 and 600 lbs.	5 DH's (marine) 4 Army Martins 11 F 5-L's (Navy)	1000-1600 ft. 1600 ft. 1100 ft.	10	Superficial damage to armor and superstructure. Sank in 21 1/2 minutes after first 2000-lb. bomb was dropped
July 21	<i>Ostfriesland</i>	German Dreadnought	12	Five 1000 lbs. and seven 2000 lbs.	12 Army Martin Bombers	2000-2500 ft.	5	



Army Phosphorus bomb hits crow's nest of "*Alabama*."—Photo, U. S. Air Service.

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July 21	<i>Ostfriesland</i>	German Dreadnought	12	Five 1000 lbs. and seven 2000 lbs.	12 Army Martin Bombers	2000-2500 ft.	5	

CHAPTER IV

REVIEW OF AERONAUTICS THROUGHOUT THE WORLD, NATION BY NATION

THE importance of aeronautics as a factor in the unification of the nations is twofold. Aerial communication, by lessening time and space, is bringing all countries into direct contact, tending toward unity of thought and civilization. The potentialities of aircraft in war have destroyed faith in obsolescent methods of attack and defense, and by increasing the fear of war, have fostered the desire for peace.

The following reports have been obtained through the courtesy and coöperation of the Information Division, United States Air Service; Naval Bureau of Aeronautics; Automotive Division, Bureau of Foreign and Domestic Commerce, Department of Commerce; National Advisory Committee for Aeronautics, and the Pan American Union, supplemented by data received by the Aeronautical Chamber of Commerce of America from its foreign correspondents.

ARGENTINA

In Argentina military aviation is under the jurisdiction of the Army Aeronautical Service. In 1921 the army flying equipment consisted of the following planes: 25 training, 24 bombardment and observation, and 10 pursuit. The personnel numbered nearly 400. The principal airdrome and training center is at El Palomar. Colonel Enrique is Director of the Army Aeronautical Service, and Captain Antonia Parodi is the technical and flying expert. For 1921 the Federal Government appropriated the equivalent of \$2,000,000 for aviation.

A naval aviation school has been established by the Division de Aviation, under the Secretary General of the Navy. The material is that which was left by the Italian Mission, and includes 2 flying boats and 1 dirigible. The personnel numbers 36. Commander Jose Gregores is Director of Naval Aviation. Lieutenant Commander Ricardo Fitz Simon is director of the school. Lieutenant Marcos A.

Zar is naval commissioner in the United States. The equivalent of about \$636,758 was appropriated in 1921 for establishing the naval aviation school. It was planned to buy 20 planes.

Commercial flying is carried on largely by private individuals or corporations with no centralized control. A commission was appointed for the furtherance of military and civil aviation, and undertook to collect funds for carrying out an elaborate program, including the acquisition of flying equipment and the establishment of terminals. The commission also planned to organize civil aviation for utilization in national defense.

The Curtiss Aeroplane Export Corporation, of New York, has established a permanent base at Buenos Aires. Richard H. Depew is in charge of operations. In 1921 Curtiss airplanes in the Argentine carried 5788 passengers, flew a total of 2434 hours and covered 316,725 kilometers or, roughly, 195,000 miles, with but one minor accident. Twice as many students received instruction at the Curtiss school as in all other schools combined, except the Government stations. The Argentine Army and Navy include Curtiss machines in their equipment, and the Aero Club of Argentina has appointed the Curtiss school as its official training station for all its students.

The Cia. Rio Platense de Aviacion, with a capital of \$127,000, also does school work and touring. The Soc. Italo Argentine, a similar organization, is capitalized at \$50,000.

Many flights have been made over the Andes: the Chilean aviation, FiGueroa, having carried the mail from Chile to Argentina. In June, 1921, First Sergeant Luis Barrufaldi, an Argentine, broke the South American altitude record, ascending 24,272 feet.

ASIA MINOR

The French operate an air mail service in Syria three times a week, between Aleppo and Alexandretta.

AUSTRIA

A bill has been presented in the Austrian National Council by which the Federal Minister of Communications is authorized to create an Advisory Committee to give expert advice on schemes connected with all kinds of communications, including Aerial Transport. Although forbidden by the Peace Treaty, Hungarian pilots are trained at Szedgedin.

AUSTRALIA

Aviation in Australia is controlled by an Air Council, with a subordinate Air Board. The Air Council consists of the Minister of State for Defence, who is President, a naval member, a military member, two members of the air board, one nominated by the Naval member and one nominated by the Military member, and the Controller of Civil Aviation. Among the functions of the Air Council are the following:

To advise the Minister upon the Air Force provision necessary from time to time for the defence of Australia; to co-ordinate the Air Force requirements of the Naval and Military Forces, respectively; to allocate the funds made available for air defence; to advise upon the general control of Commonwealth air policy, in its Naval and Military aspects, and to co-ordinate civil aviation therewith.

The Air Board consists of the Director of Intelligence and Trading, the Director of Personnel and Training, the Director of Equipment and the Finance Member. The Board is charged with the control and administration of the Air Force upon the policy laid down by the Air Council.

The sum of £100,000 was allocated for civil aviation during 1921; £500,000 was used for Service Aviation of the Air Force, the plan being carried out in using the Air Force in assisting civil aviation by doing the pioneer work by surveying, map making and arranging air routes. Direct subsidies also have been decided upon by the Australian Government, £54,000 from the £100,000 allocated having been granted for three lines as follows: Geraldton-Derby, 1195 miles (maximum subsidy £25,500); Sydney-Adelaide, 795 miles (maximum subsidy £17,500); Sydney-Brisbane, 590 miles (maximum subsidy £11,500). The personnel of these lines must be members of the Air Force reserve. The lines agree to carry 100 pounds of mail matter on each trip.

The Air Council has approved a scheme whereby aircraft material and spares may be lent from the Air Force stocks to civil concerns. The Permanent Air Force will be small and the Air Force of Australia will consist mainly of members of the Citizen Reserve Force.

BELGIAN CONGO

In January, 1921, the "Sneta" (see Belgium) announced passenger, baggage and postal rates for the King Albert Line in the Belgian

Congo. The first sector of this line included Kinshasa, Kwamouth, Bolobo, Lukolela, Gombe, Lirange, Coquilhatville and return.

BELGIUM

Aeronautical activities in Belgium are under the jurisdiction of the Ministry of National Defense, with a Director of Aeronautics, Colonel van Crombrugge, who has charge of both military and civil aviation. Naval aviation is nonexistent.

Military aeronautics possesses 100 airplanes of various types and 4 balloons (Caquot type). The personnel consists of about 100 officers and 2000 men, with about 100 licensed pilots. There are 5 airdromes and 1 depot. The air service is divided into 7 groups, comprising 15 squadrons, 11 aviation and 4 airstations. The 2 technical squadrons at the Brussels airdrome have complete workshops. The personnel is military. Theoretical research is carried on at the Aerodynamic Laboratory. An appropriation of 22,000,000 francs was made for the year 1921, including 7,000,000 for new airplanes. Plans have been made for four new squadrons and two new airdromes.

According to the report of the Belgian Air Service, aviation is destined to develop rapidly in Belgium. The country being placed between the great commercial nations of the west of Europe, there must pass over her territory the lines from England to Germany and from France to Holland. Civil Aeronautics is well organized and regulated. There are four bureaus as follows: Bureau for the establishment of aerial lines (organization of airdromes, equipment of lines, etc.); bureau for development of aerial lines (national and international lines, subsidies, development of airdromes, etc.); bureau for general questions, legal and various (international relations, information on foreign aeronautics, regulations, maps, sporting aeronautics, etc.), and bureau of technique of aeronautics (laboratory schools, meetings, mobilization of civil aeronautics).

The S. A. B. C. A. (Société Anonyme Belge de Constructions Aéronautiques) has a capital of 5,000,000 francs. Its factories and hangars are at Brussels.

The S. N. E. T. A. (Société Nationale pour l'Etude des Transports Aériens) is an operating company. During the past year, it increased its capital from 750,000 francs to 4,000,000 francs. It operates four lines, Brussels-Paris, Brussels-London, Brussels-Ostend and Brussels-Amsterdam, the two last having been established in 1921. During the six months ending November, 1921, the ships of this company traveled 187,115 kilometers in 682 trips, carrying 1294

passengers, 10,613 kilos of merchandise, 592 kilos of mail. Four machines were destroyed, one pilot and one mechanic killed, and one pilot injured. No passengers were hurt.

The Société Entreprises Générales d'Aéronautique is established at Gosselies, where it possesses its own airdrome. It specializes in training.

Subsidies amounting to 3,000,000 francs have been provided for 1922, for supporting the operating lines in Belgium; 1,600,000 francs were provided in 1921. These subsidies have enabled the companies to reduce their fares and this reduction has increased traffic. At an International Conference of Air Transport Companies held at Brussels, Feb. 25-28, 1921, reductions in fares were adopted making them practically equal to the maximum fares for international railway journeys. At a meeting of the directors of the "Sneta" held in April, 1921, it was stated that the increased demand they had experienced since reducing the fares confirmed the directors' opinion that the success of aerial transport depends on reasonable charges; the poor business done in 1920 being held due to the high rates and not to any fear of risk on the part of the public. It was also stated that it was possible to insure the company's material against accident for a moderate sum and that a broker charged only 1.3% for insurance of documents carried by aircraft.

Airdromes installed by the aeronautical administration are the property of the State. The public airdromes are open to all aircraft but foreign aircraft must be registered in one of the countries with which Belgium has concluded an agreement of reciprocity and must navigate in accordance with the regulations set forth in the International Aerial Convention, and in Belgian laws, decrees and regulations.

The Aeronautical Administration regulates the charges, military pilots being allowed a reduction of 50% if the machine is not used for commercial purposes. Air navigation companies or lessees of airdromes must have accredited representatives at the state airdromes which they use. Strict regulations are made regarding the landing and handling of passengers, freights and documents, inspection of ships, regulations as to turns, prohibition of stunting. These are in accord with the International Aerial Convention.

The Aero Club of Belgium is very active and, following the example of King Albert, numerous sportsmen own airplanes and use them regularly. The King is accustomed to taking "afternoon flights" about Europe and to crossing his own kingdom in an hour or two. He has also flown from Morocco to Toulouse, France.

BOLIVIA

The Bolivian Government has approved plans for an aviation school to develop commercial flying and improve communications with adjacent countries. The altitude of the country ranging from 12,000 to 14,000 feet requires very high powered motors. The lack of railroads and highways, however, makes aviation desirable.

Early in 1920 the Curtiss Aeroplane Export Corporation contracted with the Bolivian Government for one battleplane to demonstrate the possibility of flying from the extremely high altitude around La Paz. Numerous attempts had been made to ascend from that point without success. A Curtiss "Wasp," 400 h.p., was used and numerous flights were made from the "Alto" above La Paz, taking off at 13,600 feet above sea level.

BRAZIL

In January, 1922, it was reported that the President of Brazil had given his assent to an act authorizing the expenditure of more than £235,000 for the establishment of two aerial routes between Rio de Janeiro and Porto Alegre (in Rio Grande do Sul). One route for hydroairplanes maintained and directed by the Minister of Marine will follow the coast, while the other, under the direction of the Minister of War, will be inland, following the railways wherever possible. The primary object is military defense, but the routes may be used for commerce with the Government's consent.

Early in 1921 the Brazilian Government purchased from the French Aviation Mission 85 French machines at the reduced price of 2,000,000 francs. These machines were to be used in the Military Aviation School, at Rio de Janeiro. The Army Air Service has about 200 officers and men.

A Naval Aviation School was planned and a piece of state land selected for its establishment near Pae Cara, and bordering on the Onterinhos ground. The 1922 budget calls for increased expenditures on naval aviation.

It was announced in January, 1922, that plans had been completed for the establishment of transatlantic airship service between Spain and Brazil, making the trip from Seville to Rio Janeiro in forty hours. The ships to be used are of the Zeppelin type, to be constructed by German experts.

American, French and Italian companies have been active. The Airdrome of the Curtiss Aeroplane Export Corporation is located at São Paulo, in charge of Orton W. Hoover. The Brazilian Navy

has used Curtiss machines almost exclusively in its flying operations. Mr. Hoover organized, equipped and trained the militia school for the State of São Paulo, known as the Força Publica, in addition to turning out some of the best known Brazilian civil pilots. It was a Curtiss machine, an "Oriole" with a K-6 motor, which Edward Chavez flew from Rio de Janeiro to Buenos Aires, the first flight between these two largest cities of South America ever accomplished. Five different types of European machines attempted this feat. The flight of approximately 1200 miles was made in fifteen flying hours.

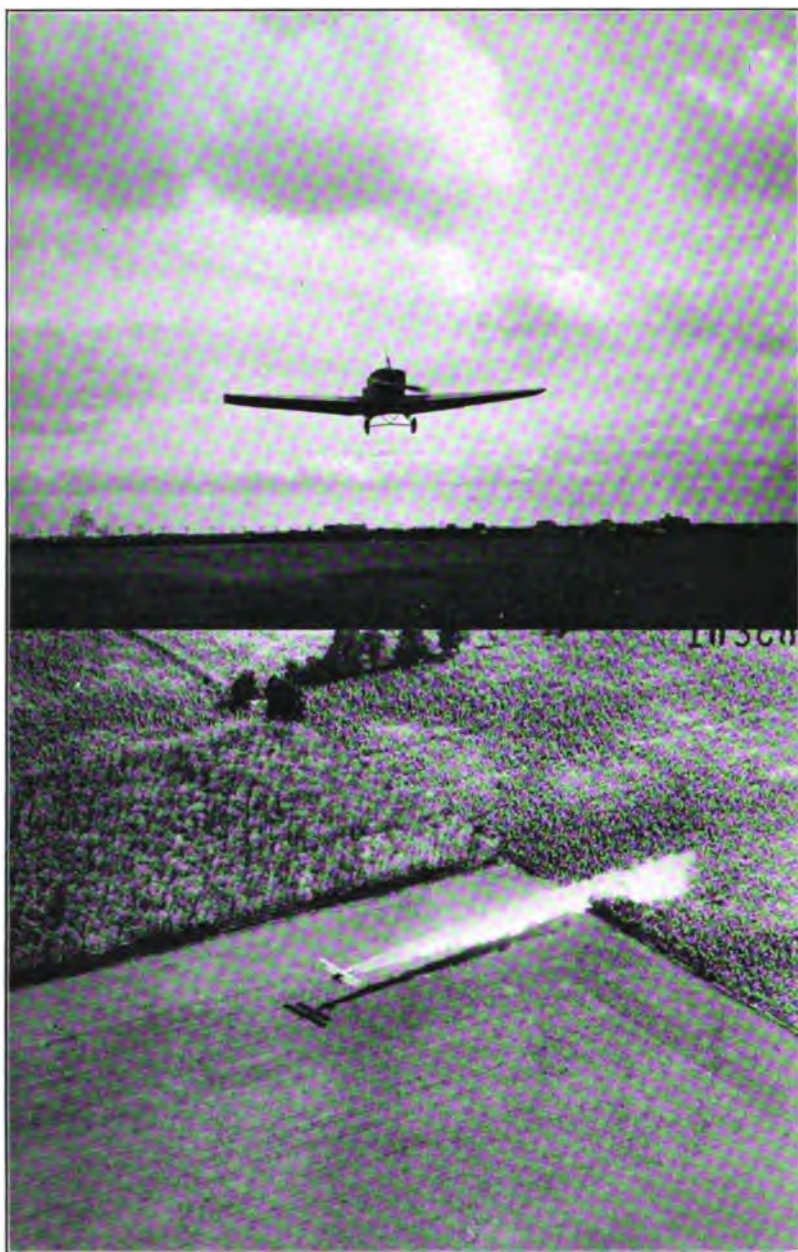
CANADA

As described in the "Aircraft Year Book for 1921," aeronautical activities in Canada are controlled by an Air Board, the military division being organized as the Canadian Air Force, operating under the Air Board. The principal training depot of the C. A. F. is at Camp Borden, Ont., where 407 officers and 840 airmen received training from Oct. 1, 1920, to Oct. 1, 1921. Other activities of the C. A. F. include photographic survey of camp area for Department of Militia and Defence, combined training with Royal Canadian Artillery, combined maneuvers with militia and permanent force on staff tour, combined training with military and naval forces, communication flying transit of machines, etc. A scheme for the training during the summer of University Cadets has been approved by the universities. These cadets may finish their flying course in three years after which they may join the C. A. F. or be transferred to the Reserve of Officers. A total of \$825,000 has been granted for the C. A. F. for the year 1921-1922.

Civilian flying operations for the government include service for the Department of the Interior, such as the forestry branch, geodetic survey branch, typographical survey branch, Dominion Water Power branch, Dominion Parks branch, reclamation service, international boundary commission, and town planning branch; service for the Department of Mines, including the geological survey branch; service for the Department of Marine and Fisheries; for the Department of Agriculture, including the entomological branch; for the Department of Customs and Inland Revenue; for the Department of Railways and Canals; for the Department of Trade and Commerce; for the Department of Public Works; for the Department of Militia and Defence; for the International Joint Commission; for the Commissions for Northern Manitoba; for the Ontario Provincial Government, including forestry and mines; for the British Columbia Provincial Government, and for the Quebec Provincial Government.



Final plunge of the "*Alabama*," after being hit by 2000-lb. bomb.—Photo, U. S. Air Service.



Larsen J. L.-6 in Canada. *Below*—Aircraft aiding horticulture—Army plane spraying grove near Troy, O.—Photo, U. S. Air Service.

The number of pilots' certificates and licenses in force Sept. 30, 1921, was 475. This included private Air Pilots 58, Commercial Air Pilots 86, Air Engineers 151, Air Navigators 1, Civilian Aircraft 58, Civilian Government Aircraft 30, Canadian Air Force Aircraft 59, Civilian Air Harbor Licenses 25, Civilian Governmental Air Harbor Licenses 6, Canadian Air Force Air Harbor License 1.

The summary of civil government flying for the period from April 1 to Sept. 30, 1921, included flights for forestry, photography and fire protection, miscellaneous reconnaissance, photographic survey, preventive reconnaissance, communication, transportation and demonstration, instructional, experimental and unspecified. The total mileage was estimated at 157,413.

Among the specific operations of interest during the summer of 1921 was a demonstration flight of 1000 miles around Lake Winnipeg and part of Lake Manitoba and as far north as The Pas and Cumberland House. This flight was made for Lieutenant Colonel H. I. Stevenson, District Forest Inspector for Manitoba, who was a passenger throughout the trip. As a result of this pioneer flight, weekly trips have been made over the same route from the Victoria Beach Station. On the initial trip while the plane was at The Pas, reconnaissance and survey of flooded districts were made in connection with land drainage and reclamation projects.

During August, a forest fire of great range, starting in Alexander Creek Valley on the British Columbia side of the Rockies, outside the area patrolled by the airplanes from the High River Air station on the Alberta side of the Rockies, spread into the forest reserve of Alberta where it was detected from the air. The fire continued for twelve days during which time the airplanes made daily patrols, bringing in reports as to the progress of the conflagration and new territories threatened, so that the fire-fighting organization could work effectually in all parts. The fire patrols of the Bow River and Crowsnest Forest reserves report an efficiency percentage of from 90 to 96% on daily flights.

In September, a flight was made from the High River station, Alberta, to explore and photograph Jasper Park. Seaplanes from the Vancouver Air Station were used in reconnaissance for the primary triangulation scheme in British Columbia. Mosquito Breeding areas in the Lower Fraser Valley, B. C., were observed and photographed from the air. A geological reconnaissance was made in Northern Ontario for the Mines Department of Ontario. Photographic surveys were made of International Boundary Waters, including the St. Lawrence River and Canal system, the Warterton

Lakes and St. Mary's River Watersheds, the Welland Canal and the St. Croix River.

The Canadian Government has not undertaken to subsidize any commercial air service. It has adopted the policy of encouraging civil aviation along the following lines: The regulation of civil flying, the inspection and registration of machines, certification of personnel and the inspection and licensing of air harbors on the principles laid down by the Convention for International Air Navigation: the establishment of a Technical Branch under the Air Board, the services of which are freely placed at the disposal of promoter of air undertakings; the survey of air routes and the provision on recognized air routes of emergency landing grounds between urban centers along any route; the establishment of an Operations Branch which confines itself to the carrying out of such flying operations with heavier-than-air machines as are required for the various departments of Government in relation to forests, fisheries, surveys, customs, etc., and to scientific experimental work; the loan of airships and lighter-than-air equipment to commercial companies.

Appropriations for civil aviation for 1921 amounted to \$700,000.

CHILE

Aviation in Chile is under the War and Navy Departments, which are branches of the Department of War. All aviation activities, military, naval and civil, are under the "Inspector General of Aviation," a Bureau Chief of the War Department. Military aviation consists of 12 Bristol Monoplanes, 8 S-E 5s, 20 Haviland 9s, 1 De Haviland Training, 8 Avro Training, 3 Sopwith. The personnel consists of 50 to 60 officers and 100 to 200 men with about 30 pilots. The plan of organization is two squadrons of 18 planes each, one of bombers and one of scouts. General Pinto Concha is Inspector General Aviation. Major Victor Huston, late of the Royal Air Force, is Chief Instructor. One million, one hundred forty-eight thousand nine hundred and fifty-three gold pesos were appropriated for use in 1921 to which was added 1,572,350 paper pesos by popular subscription, which made a total of about \$500,000 in United States money. Three hundred thousand dollars will probably be used to purchase new material.

The Curtiss Aeroplane Export Corporation, under Lawrence Leon, has established a permanent base at Santiago.

It was not until 1921 that a plane carrying a passenger crossed the Andes. Lieutenants Roberto Herrera and Alfredo Gertner made the flight from Lo Espejo, Chile, to San Luis, Argentina, in May.

Madame Adrienne Bolland flew from Mendoza, Argentina, to Chile, the first woman to cross the Andes by air.

CHINA

The Chinese Aeronautical Department was created by Presidential Mandate, Feb. 9, 1921. It is a separate ministry for centralizing the entire national air service. The Department has been designated as a strictly commercial service but all members of the staff are army or naval officers. All the Chinese flying pilots and students of the air schools are provided by the Army and Navy and have had some military or naval training. All of the six foreign pilots now with the Aeronautical Department are qualified to handle the latest war planes, all but one having been in combat in the late war. Although "Commercial Aviation" is a term used to designate the air activity (made expedient by the existence of the International Arms Embargo Agreement), the Aeronautical Department is in every sense a military service and is so considered by all the Chinese officials. An annual appropriation of the equivalent of \$2,000,000 is provided for the Department.

There are 140 airplanes in the service and no balloons. The personnel includes 100 officers, 125 pilots and students and 75 mechanics. There is a service field at Nan Yuan, 8 miles south of Peking, and one at Ch'ing Ho, 12 miles north of Peking.

The Department is headed by a Director, General Pan Chu Ying. He is assisted by a Chief of Staff and a staff consisting of Chinese army and naval officers. Colonel Holt, of the Active List of the Royal Air Force of Great Britain, has been engaged as a foreign adviser. There are six foreign pilots, three British, one French and two Americans. T. H. Chang, a returned Chinese student from the United States, has been engaged as a pilot instructor in the Nan Yuan School.

The Vickers Company made a loan to the Chinese Aeronautical Department consisting of 1,800,000 pounds sterling, with which the Chinese Government agreed to purchase aviation materials from the Vickers Company exclusively.

COLOMBIA

During 1921 a School of Military Aviation was established as a part of Colombia's scheme of national defense. This school, which is located at Bogota, is under the direction of Major René Guichard, formerly of the French Air Service. The introduction of the air-

plane has been an important factor in bringing into closer touch the various sections of this country. The rugged nature of the territory has made the construction of railroads and highways difficult so that a trip from one part of the republic to another was usually a matter of weeks. Today one may go by air from Barranquilla to Bogota, a distance of 900 miles, in 21 hours, whereas it took from 7 to 10 days.

W. Knox Martin, an American pilot representing the Curtiss Aeroplane Export Corporation, is credited with the great pioneer work in Colombia. His first flights at Bogota with a "Jennie" were phenomenal, the altitude at that point being approximately 9000 feet above sea level. He is now doing instructive work with a Curtiss-Standard with a K-6 motor. Plans are now under way for the establishment of a permanent Curtiss School at that point.

The planes of the Sociedad Colombo-Alemana de Transportes Aeos, which carry both passengers and mail, make the trip from the coast to Girardot in about 7 hours and from the latter point trains run to Bogota. The Government has granted a subsidy of \$100 a trip to this company plus a payment of 30 cents per 15 grams for mail carried. The service of this company has been extended to Cartagena on the Caribbean Coast. This company has increased its capital to \$250,000 and ordered 4 German planes, 2 of which accommodate ten passengers each. The company has been using 5 hydro-airplanes carrying three passengers each. Mail transportation takes from 1 to 2 weeks. By air it takes from 24 to 30 hours.

CUBA

In Cuba, military aviation is under the control of the War Department. Commercial flying is controlled by the Department of the Interior, which embraces the Section of Communications.

The aviation department possesses 4 planes and the personal consists of 6 officers and 42 enlisted men with 6 pilots. There is one service field and one airdrome at Camp Columbia, 8 miles southwest of Havana. About \$11,000 was appropriated for aviation last year, none of which was spent on new construction. Twelve thousand three hundred forty miles were flown with 5 accidents but no personal injury. The Military Aviation School is located at Matriculates, a few miles from Havana.

It is the unique distinction of Cuba to share in the activity of what is believed to be the leading aerial transportation enterprise in the world. For the last two years, the Aeromarine Airways, Inc., has operated a commercial service between Havana and Key West, Fla. Starting with an eleven-passenger cruiser in 1920, this service has grown rapidly, until today it is unquestionably the leading



Forest patrol over Plumas National Forest. *Below*—Timber fire as seen from the air.—Photos, U. S. Forest Service.



Flying Festival, Curtiss Field, Garden City, L. I., Oct. 16, 1921.

company in the world operating flying boats exclusively. In addition to the Key West-Havana line, spurs are extended from Florida and Cuba to other islands in the West Indies and the Bahamas. In the winter of 1920-1921 and the winter of 1921-1922, the company maintained a daily passenger service upon regular schedule. In addition to the activities in Caribbean waters, Aeromarine Airways operate out of New York and other Atlantic ports. During the year 1921 a total mileage of 95,020 was registered. All told, 6814 paid passengers were carried, and 29,002 pounds of freight transported. The distance between Key West and Havana is 110 miles, over open sea. An average schedule time of 96 minutes for this flight is recorded, regardless of weather conditions. During the earlier history of Aeromarine Airways, mail was carried, but the winter of 1921-1922 saw such an increase in passenger business that the mail space was given over to baggage. Since the Key West-Havana service has been in operation, Aeromarine Airways has carried between the island and the continent 1044 passengers, for a total of 42,000 miles of flight. Twenty-four thousand and two pounds of United States and Cuban mails and 5000 pounds of freight and baggage have also been transported. The type of craft used includes 11-passenger Aeromarine-Navy cruisers and 6-passenger Aeromarine-Navy Coast Patrol Flying Boats. The West Indian fleet of Aeromarine Airways embraces more than a score of these flying craft.

CZECHO-SLOVAKIA

The budget for 1922 allots 9,680,000 kr. for aviation. Of this, the Franco-Roumanian Company will receive 6,000,000 kr. as a subsidy in the Paris-Prague service. This is nearly double the amount of the subsidy for this line in 1922. The second International Aeronautical Exhibition was held in Prague from Oct. 22 to Oct. 30, 1921.

DENMARK

Military and naval aviation in Denmark are controlled separately by the Departments of the War and Navy. There are no governmental commercial activities of the air but commissions have been appointed by the Government to the Scandinavian Air Navigation Convention and a commission was sent to Great Britain and France in 1921 to examine the construction of airdromes, and to draw up plans for the erection of an air station at Kastrup on the island of Amager near Copenhagen. An air convention between Denmark

and Germany was held at Christianborg at the end of September, dealing with passports and customs arrangements.

DUTCH EAST INDIES

By consent of the Dutch Government and the local Governor General, two aviation schools have been founded in the Dutch East Indies at Semarang and Batavia.

ECUADOR

Military aviation is the only branch existing in Ecuador. It is controlled by the Ministry of War and Marine. The Government has seven planes in service. A school was opened on July 12, 1921, on the Guaras River, opposite the City of Guayaquil. An Italian, Elia Luit, is the instructor. There are 7 officers and 43 men. Italian, Syrian and Chinese Colonies and the Association of University Students have all subscribed funds for buying planes for the school. The Government has entered into a contract with an Italian manufacturer for the purchase of 12 additional planes. Elia Liut made the first flight over the summit of the western range of the Ecuadorean Andes.

ESTHONIA

The Esthonian Republic possesses an excellent seaplane station with a slipway to the Baltic. Large hangars of reinforced concrete are provided. The Esthonian Aviation Corps is under the command of Captain Juri-Ots and includes about 30 pilots. There are some good airdromes in the Interior of Esthonia in which there are about 20 British and Russian machines. An Airplane service between Stockholm and Reval was started July 15, 1921. Two trips are made each week, taking 3 hours and accommodating 5 passengers.

FRANCE

France leads the nations of the world in the development of civil aviation and air transport. Aeronautics is organized as described in the "Year Book for 1921." Although interest in aviation is being developed chiefly along commercial lines, all approved plans for airplanes admit of their being easily transformed into war craft and the military and naval departments of the air are continually developing new models. Three metal airplanes were built early in 1921 at the Petit Creusot factories at Chalon-sur-Saône. The type, Henri Paul B. 4, are military machines designed for night raids,

with a framework made of steel and duralumin. They are biplanes with a lifting surface of 220 square meters (263 square yards), the wings being 32.8 yards from tip to tip. The armament consists of twin machine guns fore and aft with mobile guns and their carrying capacity is nearly 4000 pounds in addition to enough petrol for five hours. There are four motors of 350 horse-power. The machine can rise to 18,000 feet and attain a speed of 100 miles an hour. Four other new types were accepted for the French Air Force, the Leiore, a very fast and flexible machine for the protection of flying squadrons, a 265 horse-power Farman reconnaissance biplane constructed of dicaluminum, a 100 horse-power Wibault special long-distance reconnaissance, utilizing the thick wing, and a new Nieuport fighter said to be faster than anything else known. Experiments with "tele-avions," small heavier-than-air machines, really torpedoes with wings, have been experimented with near Paris, at Villacoublay. They are sent up under their own power and pilotless and controlled by wireless telegraphy.

More than 600 demobilized airplane pilots of the French Army reserve were engaged in voluntary training at the end of July, 1921, at five different air centers, as a result of arrangements made by the Air Minister by which reserve pilots in civil life were offered the use of airplanes free, together with supplies, in order to encourage them to keep up their facility in flying. The pilots are given half fare rates to the airdromes at Orly, Orléans, Angers, Aulnay and Bordeaux. Twenty-seven hundred and twenty-four flights have been made by these pilots, covering 80,000 miles. No serious accidents have occurred.

Early in the summer the French naval authorities at Toulon carried out experiments in bombing an ex-German cruiser from the air. The effects were so destructive as to lead the airmen who took part in the experiment to declare that they had achieved a definite mastery over surface craft.

The total French Air Budget for 1922 is approximately 436,000,000 francs. Under the Department of the Minister of War, there is provided for the Home Squadrons 214,287,500 francs; for Algeria and Tunis 9,936,490 francs; Morocco 22,173,092 francs; total 246,219,970 francs. Two hundred eighty-six regiments, each of 12 squadrons, are provided for, using in all 40,000 airplanes.

The remarkable progress made in commercial aviation in France is due to the centralized authority, support given by the Government in generous subsidies and carefully organized landing field systems, and to the interest of the French public in flying.

M. Laurent Eynac is the Under-secretary for Aeronautics.

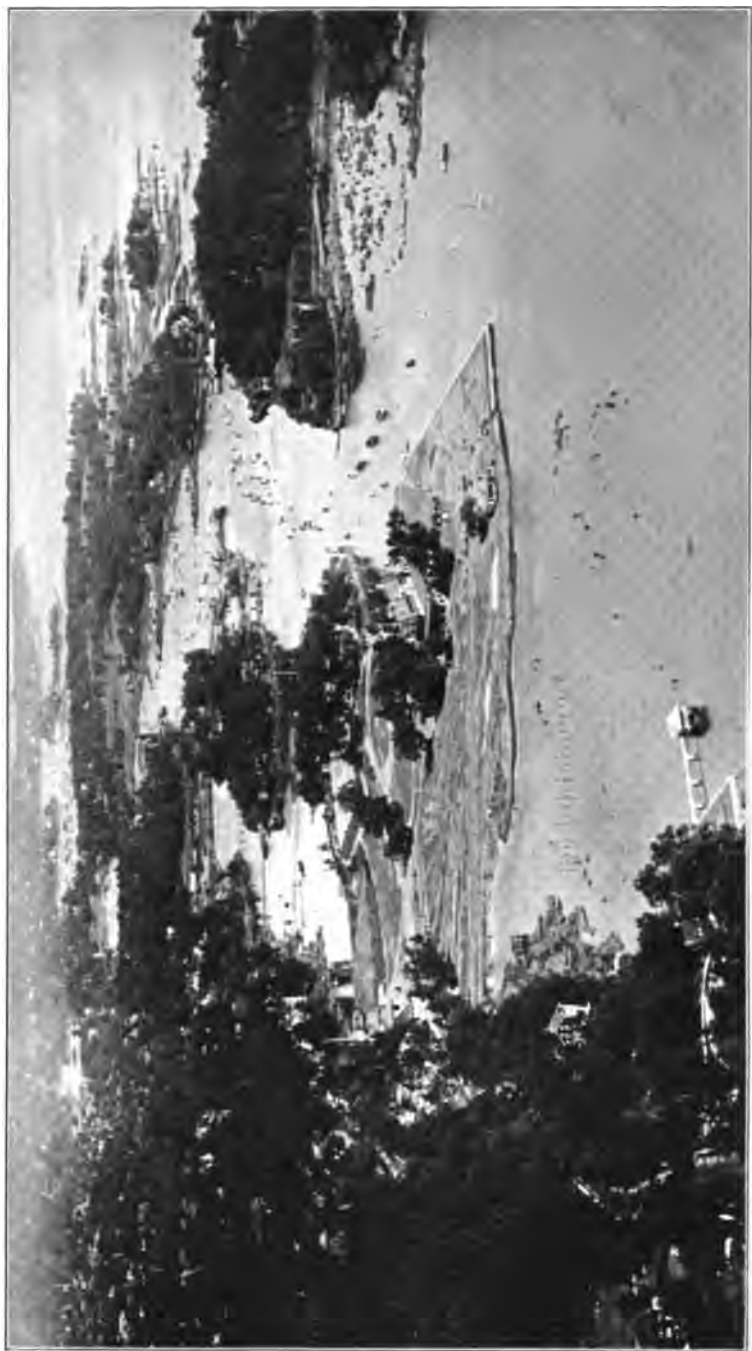
Under him the principle of unity and technical control has been reconciled with the autonomy in the administration of the commercial, military and naval branches. His department, enjoying a separate budget, has stabilized the work of its central offices and of its three main annexes, dealing with technics, construction and navigation. It has prepared efficient training centers, instituted pilots' schools, created a national office of meteorology.

The Under-secretary of State for Aeronautics also has charge of the granting of subsidies to operating companies. The budget for 1922 includes 147,219,970 francs for the department, divided as follows: foreign air attachés, 200,000 francs; technical service, 5,400,000 francs; prizes and subsidies for commercial aviation, 45,382,000 francs. The Ministry of Marine is to receive 37,318,543 francs and the Ministry of Colonies 4,991,000 francs.

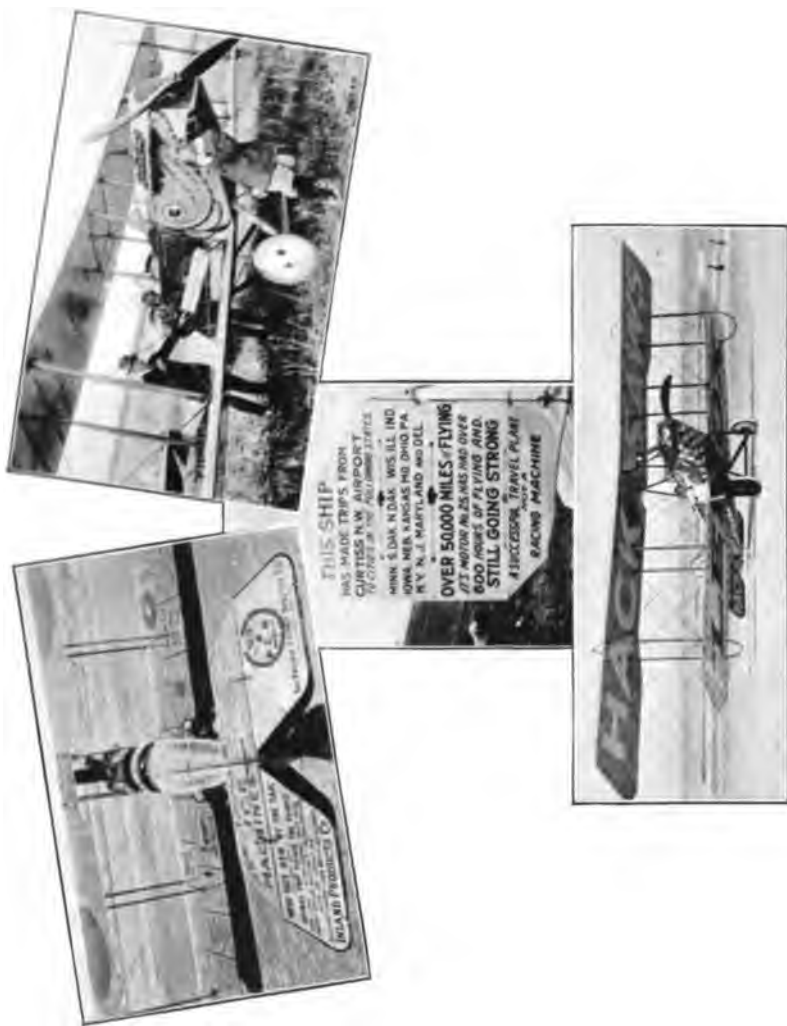
Subsidies are given only to French subjects and companies employing French material and personnel. The subsidies for purchase consist of a grant of half the value of the machine which cannot be sold or taken out of French territory without official permission and notice. The amount of subsidies granted to operating companies varies according to service and needs.

This subsidy is granted only when passengers or freight are carried and when the journey is completely accomplished. If a plane has to abandon a trip that subsidy is lost. If an average speed of 80 miles an hour is not maintained no subsidy is paid. When weather conditions are very unfavorable the subsidy can be granted if the flight shows a gain of 25% on the fastest public service by train or steamer. If there is delay at the start after weather conditions have been pronounced satisfactory, the subsidy is reduced 5% for each quarter-hour or fraction thereof. The French commercial subsidy is 75 centimes a kilometer per passenger and .005 centime per kilo of freight. Fares are fixed at the rate of 80 centimes per kilo per passenger and freight charges are .015 centime per kilogram-kilometer. Additional hourly subsidies are granted on the basis of amortissement, crew, transport and gasoline. The system tends toward regularity of operation and if the irregularity falls for two consecutive months below 40% from December to March and below 50% for any other two months, subsidies are suspended until the regularity has risen. The subsidy is also suspended if during three consecutive months the number of paying passengers or the quantity of paid freight is less than 30% of the capacity of the planes in service.

The following routes are subsidized: Paris-London, Paris-Brussels, Paris-Amsterdam, Paris-Prague, Paris-Warsaw; Bor-



Shore Line, Westchester County, New York; New York Athletic Club in center.—Photo, Hamilton Maxwell.



Aerial advertising. (1) "Spokane Industries" plane of Foster Russell Aviation Co.; (2) Heddlon Aviation Co.'s "Flying Fish"; (3) This tail tells the tale; (4) H. D. Copland helps to sell saws. All planes Curtiss.

deaux-Marseilles-Genoa; Bayonne-Santander; Toulouse-Casablanca-Oran; Bukarest-Constantinople; Antibes-Tunis; Algiers-Biskra; Dakar-Kayes; two lines in French Guiana.

Transport subsidies caused reductions in passenger fares as follows: Paris-London, reduced to 300 francs; Paris-Strasbourg, reduced from 500 to 150 francs; Paris-Prague, reduced from 1500 to 500 francs. The increase in passengers carried by airplane on French lines in the last two years as a result of carefully organized and consistent support by the Government is almost incredible. In 1919 the number of passengers was 729. In 1920 the number was 6697. For the twelve months ending December, 1921, the figures are: Flights, 4022; passengers, 13,369; goods, 150,309 kilograms; mails, 3308. During June, 1921, the French companies carried 1553 passengers, and during September, 1104. In comparing these figures it is significant that in June the British lines carried only 400 and in September 512.

The Paris-London service runs planes four times daily, the trip taking $2\frac{1}{2}$ hours. The Paris-Brussels takes 2 hours, the Paris-Amsterdam $4\frac{3}{4}$ hours, the Paris-Strasbourg-Prague 7 hours, the Paris-Warsaw, which flies daily except Sunday, $12\frac{1}{2}$ hours, the Bayonne-Bilboa-Santander, daily, $21\frac{1}{2}$ hours. In September the French lines flew 712 miles as compared to Great Britain 98, and carried 18,509 kg. of freight and 1177 kg. of mail.

Time tables are published monthly by M. Eynac, including international and intranational lines. Air passengers are picked up at their hotel by motor and taken to their destination. A system of a twenty-four-hour clock is used alike in Great Britain and on the Continent.

The longest route is that from Toulouse to Northern African points. Ordinarily this voyage must be made by train, boat and horse-drawn vehicles, requiring 4 days. By air it takes less than 2 days including an all night stop over at Alicante. The air journey costs 1680 francs as compared with 1500 francs by the old way. Passengers are allowed 20 pounds of baggage. Letters are carried for 75 cents.

The carrying of mail is considered of great importance as the revenue from mail carried to capacity would cover operating expenses. The list of air lines includes several which are used to connect France with her colonies in Northern Africa. The line to Constantinople is one of the newest, having been mapped out late in 1921 by two French airmen, MM. Deulin and de Marmier, who left Paris on Oct. 10, making halts at Strassbourg, Prague, Buda-

pest, Belgrade and Bukharest. The distance of 1770 miles was made in 17 hours effective flight.

The necessity for land organization, the creation of chains of public landing grounds, weather report stations, gasoline depots, repair shops, etc., without which commercial air progress is impossible, has been realized by France. About 19,000,000 was to be spent in 1922 on "aerial roadways" and facilities for flying. Moreover, the importance of France as the crossroads of Europe is appreciated by the Government. The basis of practical aerial roadways is the fact that the duty devolved on national governments and not on private enterprise, which would be detrimental to the general interests of the nation. Whenever there is interest in opening up two points of aerial communications, the French service de la Navigation Aérienne undertakes the whole of the ground service. Landing fields are necessary every thirty miles in countries where fog prevails and sixty miles where weather conditions permit.

In France there are five types of landing fields. Beginning with the emergency field, a simple form is all that is necessary, on land which may be held by option and kept under cultivation but which at the same time will always be kept in such a condition that planes can land with safety. Only a caretaker, a supply of gasoline, a selection of tools, a telephone and weather bureau reports are required. Besides the emergency fields, there are four classes, third, second, first and the air port. The plan provides for correlation so that as traffic increases each type can be developed into a higher class. The third class must be at least of fourteen acres with one permanent shed not less than 110 x 100 ft., a workshop, forge stores and automobile garage. There should be two trucks. In addition to the caretaker, a ground manager is necessary, a weather bureau should be established and a wireless telegraphy station installed. Additional ground should be secured to enable more sheds to be built as required. The second class is an enlargement of the third class with more sheds, better mechanical facilities and bigger supply of gasoline, oil and spares. A first class station calls for an elaborate equipment. It should have at least two permanent sheds, a long-distance wireless installation, well equipped machine shops, gasoline, oil and spare parts, central offices, customs officer if near the frontier, a station master's office, a complete weather bureau and private sheds.

The Air Port is most important and generally the terminus of international lines. It is only on the Paris-London line that the fields are laid out according to plan. It is estimated that the cost of building an aerial road is something less than \$2300 a mile, as

compared to the cost of a highway at \$23,000 a mile. Dues for landing, lighting, repairs, etc., are charged operating companies and private individuals. Arrangements for night flying which would necessitate landing fields every thirty miles equipped with flood lighting, have not yet been made.

At the present time France possesses about 30 State owned and controlled aviation grounds and about 20 privately owned airdromes.

License methods in France are well regulated. No plane can be flown unless it has been technically examined and approved and is officially registered, carrying its registration number on its wings and fuselage. No pilot can fly without an official license. Each plane carried three log books, the route log, the plane log and the engine log.

Regulations as to flying, landing, etc., are according to the International Aviation Congress, which met in Paris, November, 1921.

FRENCH GUIANA

The Société des Transports Aériens Guyanais has started a periodical service between St. Laurent and the Inini, the distance of 250 kilometers being covered in 1 hour, 50 minutes, the route following the course of the river Maroin which is the scene of important gold and forest workings. The voyage ordinarily takes 20 days.

FRENCH N. W. AFRICA

Land has been purchased 11 miles from Algiers for an airship base.

GERMANY

Germany claims to have the most up-to-date, complete and regular system of aerial traffic routes in the world today. France leads in actual mileage, Germany being second, but with the restrictions set by the Allied Aerial Control Commission removed, it is predicted that Germany will be far in advance of other nations. Heavily subsidized by the Government, air companies, largely supported by great shipping firms, have 10 trunk routes in which airplanes fly daily. These routes appear in a map shown in the travel bureau in every town in Germany. The German aerial time-tables are as complete in detail as a railroad time-table, making it possible to tour Germany by air conveniently and economically, fares in Germany being cheaper than in other countries.

It was announced in July, 1921, that by May 20, the Germans

had destroyed 14,721 airplanes and hydroplanes and 24,208 motors, besides having delivered to the Allies 2775 airplanes and hydroplanes and 1800 motors. Many of these were said to have been damaged to prevent constructional secrets being made known. Nevertheless, the *London Times*, in October, expressed doubt that Germany had turned over or destroyed the most considerable part of her aviation material and declared that Germany could build as many as 10,000 airplanes in a very short time. It stated that the German Government was exempting from taxation the capital invested in the companies engaged in the construction of civil aircraft. According to the *London Daily Mail* of June 14, a director of a German airplane company said that the Allied restrictions had helped the German air industry because they had forced the constructors to design new and more modern types of machines instead of remaining content with the old war models.

Although the Treaty of Versailles forbade Germany to possess a military air service, the German Military Staff has published complete regulations for the employment of aircraft in the army.

Aeronautical instruction is receiving much attention, and a recent memorandum drawn up by a committee of faculty members of the Hanover Technical College and the Berlin Technical College suggests that a chair of aeronautics be introduced into at least one technical college, providing laboratories and everything necessary for a thorough experimental, as well as practical, training for aeronautical engineers, the department to be assisted by the State, and that in existing institutions aviation should take its rightful place and be included in the normal curriculum more than hitherto.

There are two main bodies which virtually control all air traffic, the Deutsche Luftreederei and the Nord Deutsche Lloyd. The latter comprises eight or ten companies, including the Rumpier, Albatross, Sablatnig and Junker concerns. Lines are operated as follows: Berlin-Danzig and Königsberg, 975 marks; Berlin-Bremen and Munster, 650 marks; Berlin-Bremen and Wingerroog, 650 marks; Berlin-Brunswick and Dortmund, 800 marks; Berlin-Dresden, 500 marks; Berlin-Leipzig, Nürnberg, Munich and Augsburg, 1225 marks; Hamburg-Magdeburg, Leipzig and Dresden, 700 marks; Munich-Constance, 400 marks; Stuttgart-Constance, 450 marks; Travemünde-Warnemünde, Sassnitz and Swinemünde, 550 marks.

About 6000 miles are said to be flown daily. Mail is carried on these trips, the Post Office paying a subsidy of 21 marks per kilometer. Subsidies amount to 539,000 pounds.

During February, 1921, 70% of flights scheduled on the Berlin-Königsberg route were accomplished and it was assumed that during

the spring and summer, 90 to 95% would be accomplished. All metal Junkers monoplanes were employed.

The journey from Stuttgart to Constance takes 55 minutes as compared to 7 hours by water or rail. During March 8000 kilometers were covered on this route. An International Air Station has been planned for Constance, and an air port is to be established at Munich early in 1922.

Motorless airplanes are receiving much interest in Germany. Dr. Klemperer has flown for 13 minutes. Starting from Wasserkuppe at the summit of the Rhoen Mountains in Middle Germany, he flew to the small town of Gersfeld, passing over six villages on the way, covering a distance of $3\frac{1}{8}$ miles. This flight was made the day after the closing of the second gliding airplane tournament in which 45 gliders took part.

Germany's ambitions for the future in aviation include plans for a world-wide airship service with its center at Friedrichshaven. The Zeppelin Airship Works wrote to a German newspaper announcing connections with French firms and saying:

"Our own point of view is that aircraft transport can really become profitable if long distances are covered. It would be impossible for Germany to attempt such an organization alone. German money could not begin to meet the extraordinarily heavy expenses involved and also, for meteorological and geographical reasons Germany cannot attempt to exploit a world-wide airship transport service alone, quite apart from the drastic restrictions laid upon such German enterprises by the terms of the Peace Treaty. Therefore we must try to seize upon all interest shown by other European states in the development of a world-wide transport service. Without the sympathy of the neighboring states the vast knowledge concerning airship construction and transport at the disposal of the Zeppelin Company will be lost forever to mankind."

According to this policy is the announcement that a German technical commission is examining the southwest coast of Spain for a site suitable for Zeppelin sheds to house the aircraft to be used in the proposed Spanish-South American service. This service is planned by a combination of German experience and Spanish capital and will operate as a Spanish company.

Meantime the Zeppelin Works are busy working in two shifts, work being done on transmission gears and couplings for the motor car industry, on the Maybach engine and on flying boats. The decision that the compensation due to Entente countries for the seven airships destroyed by their crews at the time of the signing of the Peace Treaty should not be made in cash but in ships, has made it possible for the Zeppelin Works to continue construction of airships.

Ever since the Peace Treaty there has been a perpetual struggle between the German Air companies and the Control Commission. Originally the restriction on the manufacture and importation of aircraft and aircraft engines was laid down for six months. It has continued because of repeated instances in which Germans have managed to evade it and other articles of the Treaty. Restrictions were to be removed in May, 1922.

GREAT BRITAIN

Civil aviation as a reserve for military aviation and military aviation as a substitute for the more expensive units of both Army and Navy, is the new aviation policy of Great Britain. In carrying out this policy subsidies have been granted to commercial lines and new models of aircraft have been bought by the Government for use by these lines.

The organization of aviation in Great Britain is complete as described in the "Aircraft Year Book for 1921." Captain the Rt. Hon. F. E. Guest has been appointed Secretary of State for Air. The King is Chief of the Royal Air Force and the following are members of the Air Council: Captain Guest, president; The Rt. Hon. The Marquess of Londonderry, Under-secretary of State for Air and vice-president of council; Air Marshal Sir H. M. Trenchard, Bart., K.C.B., D.S.O., A.D.C., Chief of the Air Service; Major General Sir F. H. Sykes, G.B.E., K.C.B., C.M.G., P.S.C., Controller-General of Civil Aviation; Air Vice-Marshal Sir E. L. Ellington, K.C.B., C.N.G., C.B.E., P.S.C., Director-General of Supply and Research; Sir James Stevenson, Bart., additional member; Rear Admiral Sir C. F. Lambert, K.C.B., additional member; W. F. Nicholson, Esq., C.B., Secretary of the Air Ministry.

Military aviation is in charge of Air Marshal Sir H. M. Trenchard, Chief of the Air Staff. The personnel includes 30,880 with 7500 pilots. The list includes 5 air vice-marshals, 13 air commodores. Under these are group captains, wing commanders, squadron leaders and flight lieutenants. There are 56 provincial stations, 17 stations in the middle East Area, 15 stations in the Indian group and 2 in the Mediterranean group.

Experimental work is carried on at the Royal Aircraft Establishment, Farnborough, Armament Experimental Station, Isle of Grain, and instrument Experimental Station, Bigger Hill, Kent. Among the new types experiments have been made with a battleplane which carried its own scout machine poised at the tip of one of its wings. Another new machine is an armored monoplane, made with wings

of spruce covered with armor and carrying a gun near the tail wings. It is said to fly at 180 miles an hour and has risen 2500 feet in 70 seconds. A larger craft, armored on all sides and with guns pointing in all directions had also been flown successfully. The latter is a giant Sidelley-Cirkis with twin Sidelley-Deasey engines. The Night Hawk, a small machine built for speed and rapidity in maneuvering, is considered a remarkable success. It is said that a huge transport is being built, big enough to act as tender for a squadron of airplanes, carrying fuel and spare parts for them. It has tiers of wings with propellers on the wings and the engine room inside the hull.

About £18,033,400 were appropriated during the fiscal year for Military Aviation.

The United Kingdom is divided into Area Commands. The Inland Area includes all units in Great Britain with the exception of those comprising the Coastal Area and the Cranwell and Halton Commands. The Overseas Area includes the Independent Units under which are the Aeronautical Commissions of control of Austria and Germany, the Royal Air Force of the Rhine, the Middle East Area, including the Egyptian, Palestine and Mesopotamian groups, the Indian Group and the Mediterranean group.

The air lines, which it is believed will form the basis for a great scheme of connecting lines throughout the empire, have been, especially in the Middle East Area and Indian Division, chartered and carried on by military forces. It is now hoped to develop these lines commercially so that they may join the empire in peace interests and remain a reserve for military needs.

Entire control of the British mandated area in Mesopotamia has been taken from the army and turned over to the Royal Air Force. The Air Force will use airplanes for troop carriers, the mobility of the air force units enabling them to patrol a maximum territory with minimum forces. The change will save the military budget many millions of dollars and give the air force its first big test of its capacities to carry out garrison and occupation duties abroad.

Among the lines in the Overseas Area are:

Air mail between Cairo and Bagdad, operated by the Royal Air Force as part of training program in Middle East. Service is at present restricted to the conveyance of official correspondence. The distance is 840 miles in the following stages, Heliopolis-Ramleh, 250 miles, Ramleh-Amman, 65 miles, Amman-Kasr Azrak, through Transjordan 55 miles, Kasr Azrak-Ramadie, 600 miles across the Arabian desert, Ramadie-Bagdad, 60 miles. This route is believed to be practical for a paying service for mails and a limited number

of passengers. In July, 1921, a machine reached Cairo from Bagdad in 11 hours. The ordinary time required is 3 weeks.

Cairo-Karachi route, linking India and Egypt, Asia and Africa, spanning the Arabian desert and the Red Sea. In the survey of the Arabian desert, automobiles were used to mark out the way on land, scouting airplanes making the work possible by reporting conditions along the route. This route is part of 3 great trunk lines, Cairo-London, Cairo-Johannesburg, Cairo-Bagdad.

Aerial surveys have been made of the Nile Valley.

In commenting upon the appointment of Captain Guest as Secretary of State of Air, the London *Times* said:

"The balance between military and civil aviation must be struck. As a defence arm the Air has its special value which can only be recognized and calculated when the trammels of Navy and Army tradition are cut away from it. Even more difficult will it be to restore civil aviation to the place which it should have in the imaginations and aspirations of the country. No Imperial interest can compare with the need for the development of quick long-distance transport. It would work a beneficent revolution in the distribution of population throughout the British States and settlements, the most difficult of all the problems the British races have to solve and the key, if once solved to all the rest. Captain Guest may do wonders but the field for doing them is on the civil far more than on the military side of aviation."

In the early spring of 1921, the British Continental Service was suspended as a result of the subsidizing of cross-Channel companies by the countries in Europe. From April, 1920, to September, 1920, the British air traffic had been four times the foreign trade. From the beginning of 1921 to March, the British air traffic was only about one-fourth the foreign traffic, British arrivals and departures having fallen from 1997 to 644. In June, 1921, a committee, appointed by the Secretary of State for Air, to make recommendations for insuring the maintenance of air transport on cross-Channel routes, presented proposals to the Air Council. These were adopted by the Council and approved by the Lords Commissioners of the Treasury. The Air Ministry announced the same month that it was ready to put into operation a temporary scheme at once, the permanent scheme to go into effect in the spring of 1922. The permanent plan was that the Air Ministry should set aside a sum of approximately £200,000 per annum for three years, from the Civil Aviation votes. With this sum, the Air Ministry was to order a limited number of machines for transport services, embodying the latest improvements. These machines were to be let out on hire to "approved" firms. The Ministry was to grant subsidies during three years on a basis of 25% on an "approved" firm's gross earn-



Pennsylvania Railroad calls on Aerial photographer to visualize location of New York Terminal for use in time tables and advertising.—Photo, Fairchild Aerial Camera Corp.



Mount Washington, White Mountains.—Photo, U. S. Air Service.

ings. The routes approved were London-Brussels, London-Paris, London-Amsterdam. Other routes were to be approved later.

Conditions under which firms should be approved stated that the personnel must be British and that the aircraft and engines must be of British design and manufacture and the aircraft must be of British nationality. Forty-five completed single journeys in each direction on any one route during each period of three months was necessary and flight on stated routes must be completed within 4 hours. Tariff charges must be approved by the Air Ministry and monthly statements made showing gross earnings for the month on each route with certificate that no rebates had been granted. The temporary plan in operation from June, 1921, was similar to the permanent plan, £50,000 being set aside for its operation.

The Air Ministry has agreed to provide meteorological information and ground wireless services free of charge at government airdromes and to provide terminal and emergency airdromes in Great Britain together with all airdrome facilities including lighting, etc., as far as funds permit.

Additional grants were provided for amounting to £3 per passenger and 3 pence per pound freight carried by approved firms during the year ending Feb. 28, 1922. Fifty per cent of the cost of insurance of machines provided by the Air Ministry was to be paid by the Ministry up to a maximum of 10% of the value of the machines.

Four firms were approved in the fall of 1921, as follows: Handley Page Transport, Limited, London-Paris; Instone Air Line, Limited, London-Paris; Daimler Hire, Limited, London-Paris. (These lines to have extensions if desired to Manchester and Basle or Zurich.) Aerial Route Syndicate, London-Brussels.

During the six months ending September, 1921, 671 British planes flew to and from the Continent, carrying 4006 passengers. The total mileage of British commercial machines was 321,000 miles. In all 31,853 passengers and 9 tons of goods were carried. Imports by air amounted to £206,357 and exports £110,400. Few machines of advanced commercial types were available. A new Bristol ten-seater, a Handley Page and a De Haviland Monoplane of cantilever wing type were used. Rates on parcel post shipments from London to Paris were reduced on Aug. 17 as well as rates from 12 other centers, the charge from London to Paris being 1 shilling per pound up to 100 pounds and 10 pence per pound for packages over 100 pounds. Upon payment of a small extra charge parcels are delivered to house addresses on the same day they are sent from London. Passenger fare was reduced from 10 guineas to £6 6s. one

way. Time-tables are published giving schedules of flights and connections with European routes. Advertisements appear in the daily papers regarding the advantages of the various lines and the safety and comfort and speed of air travel.

The development of the commercial airship is regarded as extremely important in Great Britain. In July, 1921, at a dinner of the Royal Colonial Institute, the Prince of Wales spoke of Imperial Air Routes, saying that there was no doubt that the future of rapid Imperial intercommunications lies in the air, and that the modern communications were quite insufficient for a great commonwealth of Nations which extends to all parts of the globe. As a result of a special conference of Prime Ministers of the Dominions an Imperial Air Communications Committee was appointed. This Committee reported that of the four ships in the existing fleet, only one, the L-71, was of sufficient dimensions to make flights to Egypt carrying a commercial load without the necessity of refueling. The committee proposed two schemes to the Air Ministry, the first providing for a one-year period of inauguration to begin September, 1921, to enable a monthly service to Egypt to start in March, 1922. This would necessitate a fund of £540,000. The second scheme provided for a two-year period including service to India and demonstration flights to South Africa and would cost £1,339,000. Private proposals were received from A. H. Ashbolt, Mr. Greenhill and Lieutenant Commander Ballantyne. The time to Egypt by airship would be four days instead of sixteen days. Approval of the various parts of the dominion is necessary for the carrying out of either of these schemes and no decision could be made for several months. Meanwhile airships are stored.

GREECE

Military and naval aviation in Greece are controlled by separate departments. The Military Department possesses 33 planes in service and 20 out of service, with a personnel of 55 officers and 411 men. There are 50 pilots. The service is commanded by a member of the French Mission, Lieutenant Legaut. The Naval Department has 20 planes, mostly De Havillands and seaplanes. The number of officers and men is 579 with 60 pilots. The commanding officer is a member of the British Naval Mission, Commander Williams. Commercial flying has had little encouragement from the Government for political reasons.

GUATEMALA

An Academy of Military Aviation was established in Guatemala during the year 1921. It is under the technical direction of a former lieutenant in the French Air Force with a Guatemalan captain, a graduate pilot of an American school, as an instructor. Lieutenant Fromont flew from Guatemala City to Amatitlan and Palin, reaching an altitude of 15,000 feet.

HONDURAS

On April 19, 1921, the first airplane, piloted by Ivan Dean Lamb, succeeded in making a cross-country flight in Honduras. The trip was made between San Pedro Sula, on the north coast of Honduras, and Tegucigalpa, the capital, a distance of 216 miles. An aviation committee has been appointed to interest prominent people in the formation of a corporation which will devote itself to commercial aviation. There is no governmental aviation. Two young Hondurians have been sent to the United States to study aviation and two Americans have been employed by the Government of Honduras to train fliers in Honduras where a flying academy is being built.

ICELAND

Iceland has a successful air service. Avro machines are used in discovering shoals of fish. Several Curtiss machines have been purchased.

INDIA

The Government of India has addressed a circular to all local governments stating that the development of civil aviation will be left in the hands of the local governments. Any main air route established and any mail or public transport companies operating them will be controlled by the Central Government. Some of the English Government's gift of 60 D. H.-9's and 40 Avros were distributed to local governments, to ruling princes and to the Royal Air Force for training purposes. Those remaining were to be offered to Aero Clubs and to individuals and companies prepared to establish schools.

INDO-CHINA

The French have 2 squadrons in Indo-China, one in Cochin China and the other in Tongking. These are to be reinforced by 16 Breguet seaplanes and 8 airplanes.

ITALY

In Italy, military, governmental, civilian and commercial aviation are under the supervision of the War Department. Naval aviation is under the Navy Department. The Army Air Service, Comando Superiore d' Aeronautica, under the Ministry of War, has headquarters at Rome, and consists of five divisions. The Administrative Division, the Division of Military activities, the Division of Civil Activities, the Division of Technical activities and the Division of Aerial Defense. The Headquarters of the Army Air Service directs the technical, professional and administrative operations of the special branches and various services of the aeronautical arm, supervises the technical and industrial development of aeronautics, the organization, development and operation of the civil air activities and finally exercises a directive and controlling action over the civil and military personnel, as well as over the military aeronautical activities. It assists, supervises and controls civil, public and private aerial navigation.

General De Siebert is Chief of Air Service, Colonel Moizo is Chief of the Heavier-than-air Service, Colonel Tardivo, Chief of Lighter-than-air Service. Colonel Rossi is Chief of Staff and also Chief of the Division of Military Activities. Colonel La Polla is Chief of the Division of Civil Activities, Colonel Ferrar, Chief of the Division of Technical Activities, and Colonel Masso, Chief of the Division of Aerial Defense.

For the fiscal year ending June 30, 1922, the sum of 42,700,000 lire has been appropriated for the Army Air Service. Money for other appropriations, such as maintenance of posts, pay of Army and Navy officers, etc., is also used for the support of the Air Service. About 20,000,000 lire of the total sum will be devoted to new construction and experimental work.

Captain Vescadi is Chief of the Naval Air Service. The experimental constructing work and testing is carried out by the Experimental Department of the Army Air Service. Naval officers are detailed to this department to assist, observe and to supervise this work. For the year ending June 30, 1921, 6,000,000 lire were appropriated for the Naval Air Service.

The only Government aerial line operated in Italy is a postal mail service in Lybia operated by the Colonial Government between Tripoli and Rome. Military machines and pilots on duty with the Colonial Government are used for this purpose. The Caproni type of airplane is used for passengers and the S.V.A. type for mail service. This line is short and has been successfully operated.



Woolworth Building, New York; Brooklyn and Manhattan bridges in background.—Photo, Hamilton Maxwell.



This view of Jamaica Bay, Long Island, was taken for the Atlantic Gulf and Pacific Co. and aided in winning a claim against the Government. Below—S.S. *Resolute* on first trip to New York. United American Lines found aerial photography best way to portray character of service.—Photos, Fairchild Aerial Camera Corp.

By authority granted in Ministerial Decree, ten aviation companies have been given permission for the transportation of passengers and merchandise by airplane and to undertake flights whether for touring, propaganda, aerial photography or aerial cinematography. One of these companies has additional authority to transport passengers by dirigible and several of them have authority to instruct civil pilots and mechanics. At present no regular aerial routes are run by these companies. They are in operation at airdromes near the large cities of Italy and are engaged in emergency or pleasure flying. The largest company is the S.A.I.A.M. (Societa Anonima Impresse Aoree Milano). This organization has grown rapidly and has extended its operations throughout Italy.

During the year ending May, 1921, this company transported 3551 passengers.

For the year ending June 30, 1921, 27,000,000 lire were appropriated for civil aviation. For the fiscal year ending June 30, 1922, a total of 22,060,000 has been appropriated. An additional amount not yet determined is to be allotted to Civil Aviation for the construction of commercial airplanes. Of this amount the following is apportioned for subsidies, etc.:

For airplane and motor competitions, 2,000,000 lire; for encouragement of industrial concerns in production and exports, 500,000 lire; subsidy to private companies for operation of airdromes, 1,500,000 lire; subsidies to private civil companies for operation of dirigible routes, 1,500,000 lire; subsidies to private companies for operation of airplane routes, 1,500,000 lire.

JAPAN

The following information on aeronautics in Japan is taken from an official report supplied by the Japanese Government to the United States Military Attaché at Tokio:

"Military aviation belongs to the Army; naval aviation belongs to the Navy. Under the Minister of War there is an Aviation Bureau called the Koku-Kyoku, which controls all civilian aviation such as instruction and guiding of aviation, encouragement of civil aviators, the regulation and supervision of aviation and all other similar matters. There are eight airdromes and thirty hangars belonging to the Army. In the Army there are 6 aviation battalions, 1 balloon corps and 1 aviation school. The head of the Military Aviation Department is Lieutenant General I. Inouye; the head of the Military Aviation School is Major General T. Arikawa; the head of the Aviation Bureau in the War Department is Lieutenant General N. Sugihara. There are two aircraft carriers—the *Wakamiya* (old model, being a converted freight steamer) and the *Hosho* (under construction). There are four aviation grounds, Yokosuka, Sasebo, Kasumigaura and Omura. Three

aircraft factories are located at Yokosuka, Sasebo and Kure. There is one experimental station at Tokyo. The 1921-22 budget covering aviation items was Yen 23,000,000. Ten civil aviators will be trained every year at the expense and care of the Aviation Bureau. Yen 17,150,000 capital is invested in the design and production of aircraft. In design and production, 3823 persons are employed. There is an annual subsidy of Yen 50,000 for the encouragement and support of aviation."

From sources other than official, mainly accounts from European and Asiatic publications, and from commercial reports, the following is obtained:

The Japanese Government has been extremely active in strengthening both military and naval aviation. The tendency has been to follow French methods in the Army and British in the Navy. Soon after the war the Japanese Mission bought 300 planes in France for use in the Army. In November five large bombing planes, each carrying fifteen men arrived in Japan from France. In September four planes, built in France but equipped with Salmson motors made in Japan took part in a flight from Tokorozawa to Chahgchun, a distance of 2804 kilometers. French pilots have been engaged as flying instructors for the Japanese Army.

The naval aviation program of Japan calls for fifteen squadrons of six machines each. These are to be based at the three great naval stations in Formosa, the latter near the lower end of the island and only a few hours from the Philippines. Approximately 100 British war pilots, instructors and mechanics have been engaged by the Japanese Navy to act as instructors in the naval air force. At the beginning of the year 1921, the Japanese Navy had 270 officer pilots. This has been greatly increased. The latest naval aviation appropriations approximate \$20,000,000. Though as yet the preference has been given to military aviation in order to meet urgent military requirements, Japan is now taking steps with a view to having military and civil aviation services develop side by side. Workshops for civil airplanes can be made use of both by the Army and Navy and it is expected that in time of war the entire capacity of civil workshops can be used for military purposes. Pilots are also being trained for civil aviation by the Government, in order that a large number of trained men can be called into service in case of war. The training of civilian pilots is regulated by the Japanese War Office. The Government has also appointed by Imperial ordinances, an Aviation Technical Institute and an Aviation Council under the Minister of Education. The Institute is to be attached to the Tokio Imperial University and its work of "investigating the theoretic principles of flying machines" is to be supervised by the Principal of the University. The Minister of Education will be the president

of the Aviation Council which will have a membership of up to 20 who will be appointed by the Cabinet from among persons of learning and experience. The duty of the council will be to "deliberate upon important matters concerning the basic theoretic principles of flying machines."

It has been the policy of Japan to send representatives on missions to other countries to buy aviation material and to examine progress and plans of other governments. This policy has been followed by the employment of French and British experts to build up an Air Service in Japan and recently in inviting outside capitalists to start building airplanes in Japan as well as encouraging Japanese builders. The Japanese have worked steadily and consistently in learning what has been done in aviation in other countries, in instructing a large number of pilots, in discovering the best markets throughout the world for buying materials for airplanes, one instance being the buying of great quantities of cedar logs from the plant of the Coos Bay Lumber Company at Bay Point for the manufacture of military airplanes, and another the purchase throughout the United States of wood for propellers. The extensive nature of these purchases indicates the scale upon which Japan plans to build aircraft. A consular report from Japan announces that a factory to produce 600 planes a year will be completed shortly. H. F. Hawley, United States Consul at Nagoya, reports that work has been started on this factory by the Aichi Machinery Company of the Mitsui interests near Nagoya. He also reports that the Kawasaki Works of Kobe are contemplating the erection of airplane factories and that the Mitsubishi Motor Company has made progress in the work of manufacturing its new type of airplane and will soon be turning out complete machines.

Japan has also acquired virtual possession of an entire British aircraft plant, that of the Avro Company near Southampton, and installed a staff of Japanese superintendents and foremen. A Japanese airplane factory and aviation school have also been opened in San Francisco.

The Tokio Gas and Electric Company has opened a big powder plant and has built shops for the manufacture of arms and war airplanes.

Coincident with the arrival of the British airmen five German specialists arrived in Japan from the House of Zeiss and six from the Goerz factory. They are to manufacture periscopes and range finders and supervise Japanese workmen. A force of experts from the Short Brothers Airplane Manufacturing Works is teaching the Japanese how to assemble eight airplanes purchased by Japan from

their plant. This type is a seaplane with a wing spread of 110 feet and body of 50 feet. It has two motors of 350 horse-power, carries 6 passengers and remains in the air ten hours.

The Aviation Bureau has dispatched five detachments to make investigations connected with aerial routes. When aerial routes are fixed and suitable arrangements for landing places are devised, it is thought that the establishment of landing places in certain towns will follow naturally and they will, in turn, be followed by the establishment of private landing places.

A Government Bill for the enactment of an Aviation Law based on the requirements of the International Air Convention was introduced in the House of Peers early in 1921.

It has been decided to establish an air mail line this year between Tokio and Osaka. The Imperial Aviation Society has arranged a competitive flight between Tokio and Aomori and a trial mail-carrying flight between the same points. The same society has offered first and second prizes of 50,000 and 30,000 for a transoceanic flight between Fukuoka and Shanghai to be held in October, 1922.

Three naval airplanes made by the Yokosuka Arsenal and furnished with 200 horse-power motors are to be started June 16 on a flight from Oppama to Muroran and back, two days being allotted each way. The second civil aviation meeting is to be held by the Imperial Aviation Society on the reclaimed ground at Susaki, May 21.

MEXICO

Progress in Development

Military aviation in Mexico is organized similarly to the U. S. Air Service but is still in a state of development. Commercial flying is controlled by the Department of Communications. There is no Naval Aviation. The Air Service possesses 18 old planes of various types and has recently purchased 8 Avro training planes. There are 500 officers and men with 12 pilots. General Gustave Salinas is Chief of the Air Service. Colonel Ralph O'Neil is in charge of training and Señor S. Rivera is in charge of construction. Experiments are being made in the construction of biplanes. Six million pesos has been appropriated for the period from July 1, 1921, to Jan. 1, 1922.

The Secretary of Communications and Public Works has created a Technical Aviation Department to study all aspects of official and commercial aviation. Guillermo Villasana has been appointed head of this department.

NETHERLANDS

Aviation is regarded as of great importance in the Netherlands and considerable progress has been made during 1921, especially along commercial lines. Control is divided under the departments of War, Navy, Colonies and Works and Waterways. The aviation division of the Army is under the Minister of War, naval aviation is under the Minister of the Navy, and aviation in the Colonies is under the Minister of the Colonies with the exception of the division of Naval Aviation serving in the colonies, which falls under the Ministry of the Navy. According to a memorandum emanating from the Netherlands Minister of Public Works and Waterways, the Ministries of Navy and War in Holland will soon be amalgamated in one Ministry of Defense.

W. F. Pop is Minister of War. J. H. Hardenberg, Captain of General Staff, is commander of the Aviation division at Soesterberg. The material belonging to the Military division of aviation consists of 54 training machines (Spyker), 30 pursuit, (Fokker and Nieuport), 60 observation planes (Fokker) and some reserve machines. There are 3 camps, Soesterberg, Schiphop, Gilze Ryen. At Soesterberg there are 9 departments, each under a chief, including aviation education, training for observers, technical service, photography, radio, medical, mechanical, equipment and barracks.

W. F. Pop is also Minister of the Navy. D. Vreede, first lieutenant, is commander of Naval Aviation at Den Helder. The Department has 48 airplanes and 31 hydroplanes. There are camps at Veere, Schellengwoude, de Mok and de Kooy, the first three for hydroplanes and the last for airplanes.

In the commercial division, A. A. H. W. Konig, Minister of Public Works and Waterways, is the Chief; J. F. Schonfeld, Chief of Division of Public Works, the administrator, and E. T. de Veer is Chief Clerk.

There are no air routes under Government control but subsidies have been given various companies for the purpose of exploiting aerial service. The Royal Aviation Association was formed in 1920 and machines rented for a trial service between Amsterdam and London and to Germany and Denmark. The company was granted a subsidy of 200,000 florins for estimated losses during 1920 and 1921. Twelve Fokker and 2 De Haviland planes were bought and in April, 1921, the following routes were established: Amsterdam-London, once or twice daily; Amsterdam-Brussels, twice daily back and forth and once through to Paris; Amsterdam-Hamburg, twice daily, with stops at Rotterdam. Two million florins were appropri-

ated in the budget for 1921 as a subsidy to the Association. During 5 months in 1921 this company carried 410 passengers between London and Amsterdam, and, besides mails, nearly 18,000 tons of goods, nearly all British exports. It was stated by Dutch newspapers that commercial aerial transport of both passengers and freight had become so popular that the lines would be continued through the winter.

From April 14 to Sept. 15, the Royal Association carried 1427 passengers, 27,036,760 kg. of goods, 1,213,153 kg. of mail. Five hundred and five trips were made covering 202,000 km. No accidents were recorded. A new office was opened in Amsterdam in May. Passengers are transported by motor car to the Schipol air-drome.

Amsterdam has become the third largest commercial air station in the world. Between April 14 and Oct. 3 more than 1000 aircraft passed in and out of the station, carrying 1511 passengers in addition to large quantities of express and mail.

The total estimate for civil aviation included in the Netherlands budget for 1922 amounts to 1,315,000 florins of which it is proposed to set aside 370,000 for subsidies.

NEW ZEALAND

Aviation in New Zealand is controlled by the Air Board under the Minister for Defense. The plan of the Government is to make provision for the development of aviation along lines which would enable the Dominion to possess civil aviation for commercial and other needs and at the same time to provide for the necessities for aerial defense in case of emergency.

The general lines of the Air Board's duties in respect to commercial aviation includes advice as to companies or individuals that might be subsidized for the conveyance of mails and passengers on approved routes, the allotment by way of loan or otherwise of Government machines, the inspection of privately owned machines, the reservation of right of particular companies or individuals to fly for hire within prescribed areas. Contracts recommended by the Board are submitted to the Minister of Defense and also the Postmaster General for approval.

NORWAY

The Norwegian Air Force is under Government supervision with Army and Navy Directorates under the Ministry of Defense. Civil aviation is strictly regulated. In August, 1921, an Air Council was

established to be subordinate to the Ministry and to act as adviser in all matters connected with civil aviation. The Army and Navy departments each have a head and staff, technical department and flying school. The Army has groups at Sondenjeldske and Nordonfjeldske and Nordnorgee and the Navy has groups at the two latter places.

PARAGUAY

Aviation, both military and naval, is under the Ministry of War. Captain Herman Dalquist is Director of the Aviation School at "Campo Grande."

PERU

An Aviation Directorate controls both military and naval aviation in Peru. It is under the command of Captain Juan Leguia, an army officer. This directorate has charge of the technical and administrative service of the government aviation schools and inspects and assists in the control of civilian schools. The military branch has 9 planes. The organization is as follows: 1 Director of Air Service, 1 Director of Schools; 3 assistants, pilots or pilots' mechanics, 9 officer students, 40 enlisted men. There is one army field in operation and two not yet completed. About 75,000 miles yearly have been flown. Five hundred thousand dollars was appropriated in 1921.

Naval aviation consists of 10 hydroplanes and 2 land planes, including Curtiss "Seagulls"-French "Levys" and F. B. A.'s and 1 U. S. Boeing flying boat. The personnel includes 18 officers and 60 men, with 11 pilots. Lieutenant Simon is in command. There is one naval field. About \$200,000 was spent last year for machines, hangars and equipment. There is one seaplane for carrying torpedoes in construction.

The Naval Aviation School was formally opened in January, 1921. It is located at Ancon, a few miles above Callao. The equipment consists of 20 flying boats and seaplanes, spacious hangars and workshops.

In 1920 the Curtiss Aeroplane Export Corporation contracted with the Peruvian Government for the organization and equipment of a naval air service. "Seagulls" were used exclusively for instruction and the training was in charge of American pilots and mechanics. American machine guns, cameras, speedboats and other training equipment was also provided. Later the Curtiss Company caused to be organized a separate company under the name of the

Compania Nacional Aeronautica for the maintenance of a Curtiss civilian school in Peru. This was in charge of Maurice Mott and Lloyd Moore, the latter being a member of the NC-3 crew on the transatlantic flight. Curtiss machines made the first commercial cross-country flights in Peru.

In May, 1921, Giovanni Ancilotti, a pilot of a Mission from the Ansaldo Company of Turin, Italy, flew in a "*Balilla*" biplane from Lima to Cerro de Pasco in one hour and fifteen minutes, crossing the Andes at a height of 16,000 feet, this being the first time the Andes in Peru have been flown across.

POLAND

In Poland there is an Aviation Department of the Ministry of War. In this department there is a section for civilian aviation. Contracts have been made by the Minister of Railways with the Franco-Roumanian company for transportation through Poland on the Paris-Warsaw line, Poland furnishing landing fields and fuel. Gas, the use of fields and a mail subsidy were to be given a Polish company for a Danzig-Warsaw-Bucharest Company in 1922.

PORTUGAL

The Portuguese Government has placed the main airdromes and intermediary landing grounds on Portuguese territory at the disposal of the Compania Portuguesa de Navegacao Aeria which intends to open a regular air service between Lisbon and Paris early in 1922, with landings at Castella-Branco, Valladolid and Bordeaux.

PORTUGUESE EAST AFRICA

A sum of 100,000 escudes was set aside by the Acting Governor General at Lourence Marques to be spent on aviation in 1921.

RUSSIA

The airplane industry and the flying organization of Russia have alike disintegrated under the Bolshevik régime. After the revolution the aircraft factories at St. Petersburg and Moscow practically ceased production and in the army the fact that all would be pilots and none mechanics, reduced the flying forces.

In anticipation of the resumption of trade relations the countries neighboring Soviet Russia are making a study of the improvement of communications. The German Sablatnig Aeroplane Company, affiliated with the North German Lloyd, plans to compete with the

Hamburg America Company for the privilege of making shipments across Poland. An aviation company with service between Warsaw and Vilna is negotiating with the Soviet and Polish Governments for the extension of its service to Moscow.

SALVADOR

The Italo-Salvadorena Company has been organized in San Salvador. This organization has contracted with an Italian manufacturer for 4 airplanes of the Aviatich type with Fiat motors, carrying 2 persons, and for 1 plane for a pilot only to be used in exhibition flying.

SERBIA

Aviation in the Kingdom of the Serbs, Croats and Slovenes is under the jurisdiction of the Ministry of War and Navy, with three divisions, military, naval and civil. Military aviation consists of 130 planes of which 60 are in flying order. There are 470 men in the service with 50 pilots. Four flying depots and one school are in use. The Air Force is divided into five squadrons. General Milin Uzelac is the commanding officer. About \$300,000 was appropriated for military aviation during 1922. Plans for the immediate future include only repair of the planes which are not in flying order.

Naval aviation consists of 24 planes left by the Austrians but not yet turned over by the French. There are 5 pilots and a field at Catarro but the organization is not complete pending decision regarding the planes.

SIAM

Aerial transport service in Siam is entirely in the hands of the military authorities. Siam has 25 landing places and 5 airdromes. At Don Nuang there are 115 planes including school machines and a staff of 650 men. The transportation of mails has been begun by the Siamese Government.

SOUTH AFRICA, UNION OF

Pending legislation on civil aviation a Civil Air Board has been appointed by the Government to deal with all matters connected with civil aviation or aerial services referred to it by the Government and to advise upon all matters of general policy affecting civil aviation. The South African Air Force with headquarters at the

Swartkops Flying Station, Pretoria, has 2 hangars, 6 machines and 6 trained pilots. One hundred and twelve airplanes have been given to the Air Force.

SPAIN

All aerial traffic in Spain, including Military, Naval and Civil, is controlled by the Government, royal decrees being issued as to routes, airdromes and regulations of flying. There has been no interruption of the Bayonne-Bilboa air service since June, 1920, and the service has been extended to cover the section from Bilboa to Santander. Bilboa has been decreed a customs port for hydroplanes. Spanish troops besieged in Morocco depended upon airplanes for food and munitions, 13 Ansaldo planes being among those used.

SWEDEN

The Swedish Military Air Service is under the War Department and the Naval Air Service under the Naval Administration. There is a joint Naval and Military Commission. Civil aviation is carried on by individual companies controlled by an Air Traffic Committee under the Department of Communications. Governor Sahlin is president of the Committee.

Several companies have been organized for commercial flying, among them the Nordiska Luftredersibolaget (Northern Air Transport Company), Thulin Aircraft Company, Svenska Lufttrafik Norrlandska Luftrederi.

The Svenska Lufttrafik carried on seaplane service from Stockholm to Reval. This company was authorized by the Government to carry on air traffic with the companies from Denmark, Holland, Norway, Germany and England.

SWITZERLAND

In Switzerland military aviation, as a branch of the War Department, and civil aviation "Office Arien Federal" as a section of the Railroad and Post Office Department, operate under the jurisdiction of the Federal Council. There is no naval aviation. The Director of the Federal Aerial Office is Major E. M. G. Isler.

Commercial flying is carried on by three or four private companies, which do not operate regular lines but have transported more than 15,000 passengers with a perfect safety record. There were no subsidies for 1921 but 150,000 francs has been appropriated for

subsidies for 1922, to be divided under three heads, to companies which employ Swiss military aviators, to companies which buy modern commercial machines and to companies which will exploit a regular aerial line.

Switzerland has been Europe's railroad junction and is ambitious to be an air center. The Government appreciates the importance of the development of national civil aviation as a reserve for the numerically weak military air force. Touring by air is a popular attraction in Switzerland and lines have been routed from London and Paris to Alpine resorts. Durafour, a pilot, made a landing on Mount Blanc, dropped into a crevice in trying to take off, righted his plane and emerged.

TURKEY

The airdrome at Constantinople has been turned over by the French Ministry of War to the Ministry of Public Works for employment in civil aviation, together with the French military air personnel and material.

URUGUAY

Aviation in Uruguay has tended more toward linking the country with its neighbors than toward uniting the cities within the republic. The School of Military Aviation is located at Paso Mendoza about eight miles from Montevideo. The Aero Club of Uruguay was organized in 1921.

Military aviation in Uruguay is organized after the American plan, following the ideas of Major Cesareo L. Berisso, a graduate of aviation in the U. S. during the World War. The director of military aviation is Major Victoriano Rovira. A total of 150,000 pesos or \$155,100 was appropriated for military aviation for the fiscal year of 1921. The equipment consists of 31 airplanes (5 Avros, 8 Spads, 4 Breguets, 1 S.V.A., 12 Nieuports, 1 Caproni). The personnel consists of 17 officers and 80 men. A sum of 5,000 pesos (\$5,170) was appropriated for civil aviation.

VENEZUELA

Military and naval aviation in Venezuela are under the Department of War and Marine. The School of Military Aviation is located at Maracay. Colonel Lopez Enriquez is Director of Aviation and Captain Fernandez is Secretary. The equipment consists

of 7 airplanes, Caudron and Farman types, and 4 hydroplanes, Caudron and Farman types. There are 11 officers and 62 men. The officers are pilots. New equipment is being purchased from the French Government. On July 21, 1921, an aviation law was promulgated, prescribing the conditions of flying and landing in national territory.

CHAPTER V

TECHNICAL PROGRESS IN AIRCRAFT CONSTRUCTION DURING THE YEAR

THE past year, as far as the American aircraft industry is concerned, has been marked by a fairly large number of new developments, and also by much new conversion of surplus war equipment for commercial purposes. Most of the new types of airplanes produced are destined for military and naval uses, for the Army and the Navy are still the principal users of aircraft. New commercial airplanes have been brought out in relatively small numbers, as there still is on hand a large amount of surplus war equipment which the Army and the Navy are placing on sale at extremely reduced prices. This equipment has undergone varied conversions, and is showing up well in operation despite the fact, borne out by experience both in this country and abroad, that converted war aircraft are not as profitable in commercial operation as are machines specially designed for that purpose. Nevertheless, statistics show that such ex-war airplanes and seaplanes as are in operation in the United States can be used in passenger and freight carrying work with success, though with small if any profit. This is a valuable indication for the near future when commercial aviation will have used up the surplus war equipment, and will be able to operate with airplanes specially built for peace-time uses.

ARMY AIRPLANES

Among the new types of airplanes designed for use in the Army Air Service is the USXBIA, built by the Dayton Wright Co., a two-seater night observation biplane fitted with the 300 h.p. Wright Aeronautical Corp. engine. This machine has a performance superior to that of the D.H.-4-B, fitted with the 400 h.p. Liberty engine, and the gain in performance indicates improved knowledge in airplane design and construction. Another purely military type is the GAX Ground Attack Triplane, built by the Boeing Airplane Co., which was developed for attacking troops and encampments, and which is for this reason armor-plated. This machine carries a very heavy armament, consisting of a 37 millimeter quick-firing gun, and eight ma-

chine guns, and is a remarkable development in its class. Both the USXBIA and GAX were developed by the Engineering Division, Air Service, at McCook Field, Dayton, Ohio.

Development has continued on the Glenn L. Martin Bomber, fitted with two 400 h.p. Liberty engines, which is now considered one of the best military machines of its class in the world. The Army has placed large orders for this type with the Aeromarine Plane & Motor Co., the Curtiss Aeroplane and Motor Corporation, and the L. W. F. Engineering Company.

Great progress has also been made in the development of pursuit planes, the Thomas-Morse Aircraft Corp.'s M.B.-3 being placed in production, while an improved model of this type, known as Model M.B.-6 is undergoing tests. The Thomas-Morse Company has also produced a high performance semi-cantilever monoplane, Model M.B.-7, which is in course of acceptance by the Army Air Service. In this connection it is an interesting indication of the tendency prevailing in airplane construction that both the Army and the Navy display a preference for internally braced thick-wings, and in several cases call for all metal construction. Another pursuit machine, which is also of the semi-cantilever type, is the Loening Aeronautical Engineering Corp.'s single-seater monoplane, which is remarkable for its fine performance and excellent field of fire.

Various military types are still under development, such as the Gallaudet Aircraft Corp.'s long-range day bomber, fitted with the McCook Field 700 h.p. engine, the Loening pursuit biplane, fitted with the Wright 400 h.p. radial engine, and the Barling Bomber, fitted with six Liberty engines.

An airplane designed for military communication service, but which also has a field of its own in civil aviation, is the "*Messenger*," designed by the Engineering Division of the Army Air Service, and built by the Lawrence Sperry Aircraft Corporation. This small biplane has an excellent performance with its 60 h.p. Lawrance Aero Engine Corp.'s radial air-cooled motor, and owing to its low landing speed, it can be landed in very restricted places.

NAVAL AIRCRAFT

The heavier-than-air craft specially developed for naval service during the past year include the Curtiss Torpedo Dropper, the Douglas Co.'s Torpedo-Dropper, and the Elias Expeditionary Airplane, developed and built by G. Elias and Bro.

The Curtiss Torpedo Dropper is a very promising development, as it marks a notable departure in seaplane construction. This machine is a cantilever monoplane fitted with two Curtiss model C.D.-12

400 h.p. engines, and carries a crew of three. The floating portion consists of two pontoons, so as to leave clear space for the dropping of the torpedo which is slung under the fuselage.

Although of more conventional construction, the Douglas Torpedo Dropper shows equally great promise, judging by tests. The single-bay, high-lift wing structure of this seaplane insures a very fine performance, while at the same time it keeps the machine within a size easy to stow aboard ship.

The Elias Model E.M. expeditionary biplane is an interesting example of a heavier-than-air craft which can quickly be converted from land use to sea use, and vice versa, as the pontoons can be exchanged without difficulty for a wheel landing gear. Such a machine has its special usefulness in connection with naval operations from advanced bases.

Among the naval aircraft still under development is the Aeromarine Model A.S. shipboard plane, built by the Aeromarine Plane and Motor Company; the Stout Engineering Laboratories are working on a cantilever type monoplane for naval torpedo carrying.

MAIL AIRPLANES

The U. S. Air Mail Service has continued operating its trans-continental line from New York to San Francisco with converted war airplanes. Only one type is now used, the D.H., which has a maximum mail load capacity of 550 pounds, and although this machine is far from ideal for the purpose, it is the best considering the appropriation available. Lack of necessary funds last year has prevented the Air Mail Service from experimenting with special types of airplanes built for mail carrying.

COMMERCIAL AIRPLANES

Among the new commercial types of airplanes produced during the year special mention is deserved by the Huff Daland Aero Corp.'s "*Petrel*," with the 90 h.p. Curtiss OX5 engine, the new Longren Aircraft Corp.'s biplane with the 60 h.p. Lawrance air-cooled engine, and the Ordnance Engineering Corp.'s "*Orenco Tourister 11*" using the 190 h.p. Wright engine. The Huff Daland "*Petrel*" three-seater is chiefly remarkable for its unusually robust construction and low landing speed—a feature which should popularize this machine in those parts of the country where landing fields are few and far apart. The new Longren biplane is characterized by a very fine performance for the power employed, and is also notable for the use of vulcanized fibre in the construction of the fuselage. Finally the

"Orenco Tourister 11"—a modification of the model brought out the preceding year—is a four-seater commercial airplane in which maneuverability and a good performance have been allied with a conventional biplane truss, with a view to inexpensive construction. E. M. Laird Co.'s "Swallow" is a high performance 3-seater built around the Curtiss OX engine which has met with excellent commercial response.

Of the airplanes which had already previously demonstrated their qualities, the J.L.-6 all-metal monoplane of the J.L. Aircraft Corporation gave a remarkable demonstration of its great load carrying capacity by conquering for America the world's duration record with 26 hours 19 minutes and 35 seconds. This flight, made by Edward Stinson and Lloyd Bertaud, took place on December 30-31, 1921.

Only two new commercial seaplanes were produced during the past year, but they both deserve special mention by virtue of the unusual features they embody. One, the Loening Air Yacht, is a semi-cantilever flying boat fitted with the 400 h.p. Liberty engine, and carried four passengers and pilot at a maximum speed of 125 miles per hour. This machine has given several demonstrations of its great qualities: On Aug. 16, 1921, piloted by Dave McCulloch, it made a new world's altitude record for seaplanes when it reached a height of 17,550 ft. (corrected) with four men on board; while on April 17, 1922, piloted by Clifford Webster, the Loening Air Yacht flew from Palm Beach, Fla., to New York City, a distance of 1220 miles, in 9 hrs. 56 min. Following various commercial demonstrations during the past winter on the Florida coast, several flying boats of this type have been sold for private use.

The other new seaplane is the Dayton Wright Model F.P.-2, specially built for forest patrol work in the Canadian woods. This machine is a twin-float biplane and is powered with two Liberty engines. The equipment is very elaborate and allows much space to its occupants, of whom normally four are provided. Special provision was made in the design of this machine to give the crew as large an angle of vision as possible, so forest fires could promptly be detected, and all observation work, mapping, etc., be carried on without interference.

Of the converted war aircraft used for commercial purposes, the Aeromarine Navy F.-5-L and H.S. flying boats have—as in the preceding year—given an excellent account of themselves, carrying thousands of passengers without the slightest accident. These machines, and particularly the F.-5-L type, are still the only aircraft used in this country for scheduled public air transport, and their



Aeromarine A. S.-2, 300 h.p. Wright engine, developed for Navy.



Curtiss C. T. Seaplane, two Curtiss 400 h.p. C. D.-12 engines, developed for torpedo carrying for Navy.

record of safety is a testimonial to their excellence of construction and adaptation by the Aeromarine engineers.

RACERS

A very fine performance was put up by the Curtiss Navy Racer at the last Pulitzer Trophy Race, which it won at an average speed of 176.2 m.p.h., while the Curtiss "*Texas Wildcat*," which came in second, also showed the excellence of Curtiss design and construction, for this machine was originally built for the 1920 Gordon Bennett race, and the only modification which it underwent since consisted in replacing its monoplane wings by a triplane wing form. Both machines were fitted with Curtiss engines; the Navy Racer with the C.D.-12 direct-drive 400 h.p. model, and the "*Texas Wildcat*" with the C.-12 geared drive 435 h.p. model. The speed made by the Curtiss Navy Racer constitutes a world's record for speed over a closed course.

AIRSHIPS

The outstanding American achievements in lighter-than-air construction during the past year was the production by the Goodyear Tire and Rubber Company of the Model A.C. airship. This is of the nonrigid type, and differs from other ships of its class by the mounting of the car which is so suspended as to closely adhere to the envelope. By this means head resistance is greatly reduced and the performance is correspondingly improved. Owing to the close proximity of hydrogen and the inflammable gasoline, comprehensive safety precautions are embodied in this construction to prevent fire hazard. The Airship Mfg. Co. of America is engaged upon construction and development work for the government.

AERONAUTICAL ENGINES

Progress in the development of aeronautical power plants, though important from the military viewpoint, has been less marked in the commercial field. No distinctly commercial aviation engine has so far been produced, manufacturers having on the main endeavored to adapt existing military engines to commercial work by rerating them with lower mean effective pressures. These modifications have proven generally satisfactory for commercial purposes, the life of the engine being thereby greatly increased. The Liberty engine which the U. S. Air Mail Service currently uses throttled down to about 300 horse-power is an example of this tendency.

One factor which retards the growth of commercial aviation is the high initial cost and high operating cost of aeronautical power plants. Reliability has been achieved since the Army and Navy Air Services attach more importance to durability than high performance at any cost—the 50-hour endurance being a measure of this new tendency. However, initial cost is still high and will remain so unless manufacturers can concentrate on the production of a few standard models, but it is rendered difficult by the great variety of types required by the Army and the Navy Air Services. This may be visualized from the following enumeration of aeronautical engines which are either standardized or under development by these Services for different purposes:

ARMY AIR SERVICE

Training—Wright Model E2 180 h.p., water-cooled; Lawrance Model R1 180 h.p. air-cooled. These engines can also be used for light pursuit work with minor changes to increase their volumetric efficiency.

Heavy Pursuit—Wright Model H.-3 300 h.p. water-cooled; Packard Model 1237, 300 h.p. water-cooled; under development; Curtiss 375 h.p. water-cooled, and Wright Model R.-1 350 h.p. air-cooled.

Corps Observation—Liberty Model 1921, 400 h.p. water-cooled; Packard Model 2025, 550 h.p. water-cooled.

Heavy Bombardment—McCook Field Model W. 700 h.p. water-cooled; and McCook Field 18 cylinder 1000 h.p., still under development.

NAVAL AVIATION

The following aeronautical engines have successfully passed the Navy 50 hour endurance test and are standardized for service in Naval Aviation:

Heavier-than-air Craft—Lawrance Model J.-1 200 h.p.; Wright Model E.-2, 180 h.p.; Aeromarine Model U.-8-D, 200 h.p.; Curtiss C.D.-12, 350 h.p.; Wright Model T.-2, 525 h.p.

Airship Engines—Packard Model 1A1551, 300 h.p.; Wright Model D.-1, 400 h.p.

The majority of these engines represents post-war development, and the success attending their exhaustive testing by the government is a high testimonial to the excellence of American engine builders. In this connection particular mention should be made of the Aeromarine, Curtiss, Lawrance, Packard and Wright engines of different

models produced during the past year, the successful production of which represents an extremely creditable showing in the midst of the post-war depression. The development of two new airship engines, at the request of the Navy, is particularly to be noted as a new American development of much promise.

Some very interesting driving mechanisms were tested during the year. Among these may be mentioned the Hart reversible propeller, which Army experiments have shown to be thoroughly practical. This propeller can not only be varied in pitch in flight in order to obtain maximum efficiency but, as the name implies, it may be completely reversed so that the pilot on touching the ground can come to a very short stop.

The Navy has successfully concluded the development of dependable reduction gears in connection with the Liberty engine, the trials of which were very satisfactory, while the Gallaudet Aircraft Corporation has produced the Multiple Engine Drive by means of which a single 18-foot propeller is so geared to three 400 h.p. Liberty engines that it can be driven by any one or all engines of the unit. This is an extremely valuable development, which tests have shown to be very efficient.

The National Advisory Committee for Aeronautics, in conjunction with the Navy, has for some time been pursuing the development of a heavy oil engine which would operate by direct injection of fuel at high pressure and so do away not only with the highly volatile gasoline, but also bring about the suppression of delicate accessories such as magneto, spark plugs and carburetor. The experimental engine which has been built on this principle has not yet fully solved the problem, but present indications show a strong probability of ultimate success.

Parachutes—Parachutes and life packs are now carried by most experimental flyers and on all dirigibles. Their reliable operation has been demonstrated by innumerable tests ranging from one hundred feet to twenty-three thousand.

Cameras—Photographic mapping has reached a thoroughly perfected stage. A complete map of a large city can be constructed in a comparatively short time. The Fairchild Aerial Camera Corporation have continued aerial camera construction and development since the war with the idea of demonstrating many commercial uses for it. More attention has been given to perfecting the stabilizing devices and operating mechanisms.

Alloys—Duralumin in sheet, tubes, bar, rivets and some screw machine products may be obtained as there are now two concerns in this country producing this metal commercially.

While steel to government specifications is very difficult to obtain, the Army have a stock of certain sizes which they furnish to contractors of experimental airplanes.

Instruments—Instrument development in the past year has been more a process of refinement and improvement of existing instruments than the creation of new types.

Considering first the power-plant instruments, a new gasoline level gauge has been placed on the market by the Pioneer Instrument Company.

In the group of "flight" instruments, new models of Turn indicators have been brought out both by the Lawrence Sperry Aircraft Company and by the Pioneer Instrument Company. Both of these companies have also produced "Flight Indicators" or combined Turn and banking indicators. The Equipment Section of the Air Service, at McCook Field, has combined into a "Cloud Flying Instrument Board," a Turn indicator, compass, and fore-and-aft and lateral inclinometers.

Developments in navigating instruments have centered around sextants and speed and drift meters. Sextants with bubble-type horizontals have been made by the Bureau of Standards and by the Royal Aircraft Establishment (British). The French have constructed a gyroscopic sextant, the Bonneau-Derrien-LePrieur.

Progress in speed and drift instruments has been along several distinct lines. The Bureau of Standards has worked out an instrument using a rotary optical system which neutralizes the apparent drift, and thereby gives a basis for measuring it. The Pioneer Company has built a new model of their speed and drift meter, which is of the open-vane type. The same company has also produced during the past year the following instruments for use on dirigible and free balloons: a "navigator" combining a compass and speed and drift meter, a combination accelerometer and rate-of-climb indicator, an improved model of their low range indicating manometer, and a low range recording manometer.

Aircraft radio development during the year has been devoted largely to the refinement and improvement of existing apparatus. Some interesting work has been done at the Bureau of Standards on the use of radio for guiding a plane to a safe landing in fog or at night.



Flying boat "*Lady Baltimore*," of Easter Airways, Inc., of Baltimore, Md., at Palm Beach, Fla. Below—Vought V. E-7, 150 h.p. Wright.



Dayton-Wright forest patrol seaplane, showing instrument installation. *Below*—Thomas-Morse M.B.-6 biplane, 400 h.p. Wright engine.

CHAPTER VI

AIRSHIPS IN COMMERCE

NINETEEN TWENTY-ONE was a year of astonishing contrast in airship development. It was characterized by a tenacious belief in the useful future of lighter-than-air craft.

The airship situation, with particular reference to commercial application, intimately involves the settlement of post-war problems. As in airplanes and motors, so in airships, the Germans had learned much by which the Allies desired to profit, hence, after the Armistice, investigation began which eventuated in the distribution of material. Types of Zeppelins, military and commercial, were sent to Great Britain, France, Italy, Japan, etc., and steps taken shortly thereafter to have the great construction sheds of Luftschiffbau-Zeppelin at Friedrichshafen torn down and the engineering facilities dispersed.

U. S. GETS REPARATIONS SHIP

Diplomatic negotiations between the United States, the Allied governments and Germany continued for many months, but it was not until after a portion of the Zeppelin plant actually had been razed that the Council of Ambassadors made it possible for the Germans to begin construction, on behalf of the American Navy, of a modern Zeppelin to take the place of the reparations airship which was due the United States but which we had not received. This approval, however, did not come until early in 1922. The reparations ship is to be built by Luftschiffbau-Zeppelin at Germany's expense, to cost 3,031,665 gold marks, approximately \$750,000, and will be about 2,500,000 cubic feet capacity. It is to be flown to the United States Navy hangar at Lakehurst, N. J.

In the meantime, both the Army and Navy Air Services undertook to profit by European airship experience. The Navy purchased from Great Britain the R.-38, an untried adaptation of the Zeppelin idea, and arranged to fabricate in this country the Z.R.-1, modeled after the L-49 and based directly on Zeppelin theory and experience. The Army purchased from Italy the semi-rigid "*Roma*." Shortly

before the R.-38 (known to the U. S. Navy as the Z.R.-2) was turned over to us, and shortly after the "*Roma*" actually was delivered, both ships were destroyed with heavy loss of life. These distressing accidents would seem to have been mortal blows to the development of lighter-than-air craft. To the contrary they provided the stimulus necessary to a public appreciation of our backwardness in this branch of the art and the imperative wisdom of a policy of learning through actual experience and not by adaptation.

AIRSHIP ACTIVITY IN U. S.

Airship interest in the United States, after the Armistice, crystallized into four activities—the continued experimental and construction work, on behalf of the Government, by the Airship Manufacturing Company of America and the Goodyear Tire and Rubber Company, the designation of Harry Vissering as American representative of Luftschiffbau-Zeppelin, and the formation of the American Investigation Corporation and General Air Service, by a group of American capitalists and engineers. The latter two corporations have taken over the world-rights to all the patents, engineering data, research data and good will of the Schuette-Lanz Airship Company of Germany.

THE ZEPPELIN DEVELOPMENT

To Mr. Vissering, American representative of Luftschiffbau-Zeppelin, the editors of the Aircraft Year Book are indebted for the following:

Rather early in his life, Count Zeppelin, born 1838 at Constance, Germany, fell upon thinking about the problem of the dirigible airship. It may be left open whether he received his decisive impressions in the American Civil War, in which he took part as a volunteer and had the chance of making a captive balloon ascent, or in the Franco-German War, while watching the numerous free-balloons leaving Paris during the siege. In fact, already in 1873 he had designed a large rigid airship, subdivided into single compartments and emphasized the importance of such aircraft for long-distance transportation and the civilization of mankind. In 1887 he submitted a memorandum to the king of Wurttemberg, in which he explained in full detail the requirements for a really successful airship and stated that for all reasons such ships ought to be large and of rigid construction. In 1894 Zeppelin completed with the assistance of the engineer Kober his first design, which in the essential

parts is entirely similar to the modern rigid airship. He submitted them to a specially appointed committee of the most famous German scientific authorities, but was greatly disappointed by the committee deciding that it could not recommend the practical execution of the project, although no essential faults could be proven with the design.

In spite of such and considerable other difficulties, Count Zeppelin persisted and succeeded in getting the money, which enabled him together with his own resources to build his first ship during 1898-1899.

The ultimate success of Count Zeppelin in securing the lacking money was instigated and greatly aided by an appeal to the financial public made in 1898 by the German Society of Mechanical Engineers, which after a thorough investigation of the Count's designs by another committee of engineering authorities came to strongly recommend his project for financial support to the industrial and capitalist circles.

FIRST ZEPPELIN EXPERIMENT

The first Zeppelin experiment took place on the 2nd of July, 1900, and together with two other flights, although hampered by all kinds of bad luck, was a complete technical success. The ship with only 32 h.p. attained a speed of 18 m.p.h. and demonstrated the possibility of a perfect navigability in the air and of easy and safe landing on the water or the solid ground. However, with these experiments carried through successfully, the available money was exhausted and it was for Count Zeppelin to start afresh the wearying campaign for the capital. Although he was indefatigable in trying to enlist new partisans for his ideas he did not succeed in the first following years.

Only in 1906 the second airship, which was to the greatest part built with the rest of the Count's own money, was ready for its first flight, which took place in January in rather unfavorable weather. The ship, due to engine failure, had to make an emergency landing and was soon afterward destroyed by a severe winter storm. But already in October of the same year the third ship made several splendid demonstrations which induced the Government to assist Count Zeppelin in the continuation of his work by erecting a new floating shed for him and promising further assistance, if certain demonstrations and tests—rather severe ones for the time, a 24-hours' flight among them—could be accomplished with the existing airship. But the Count had now such unswerving faith in the ultimate success of his inventions that he took the chance of hopeless

bankruptcy and even constructed a fourth ship, with which to fulfill the Government's conditions.

FLIGHT AROUSES ENTHUSIASM

During the winter 1907-08 the old shed together with the ship was badly damaged in a storm. But already in July, 1908, Count Zeppelin aroused enormous enthusiasm in German expert circles and among the international public in Switzerland by a 12-hour trip from Friedrichshafen through Switzerland over Luzern and Zurich, which was made without any trouble and gave him the perfect confidence as to the success of the 24 hours' flight. This was started on 4th of August and watched by the breathless sympathy of the whole German people; the ship flew over the Rhine Valley to the predetermined turning point—Mayence—and back to the South. One of the two engines, which had given incessant trouble already on the first leg of the trip, went finally to pieces near Stuttgart, so that it became necessary to land, because it was evident that the ship had not left speed enough to reach its home base against the strong head wind, which had begun blowing during the night. The ship stayed on a field near Echterdingen from early morning until afternoon and while everything was tried to get the damaged engine into working condition, the ship was totally destroyed by a sudden unexpected squall and everything seemed hopelessly lost.

But already a few days afterwards it was clearly to be seen that the old Count had in fact definitely won his fight for the recognition of his invention. The actual accomplishments of this and other flights had created such an enormous enthusiasm everywhere in Germany in spite of the secondary accidents, that a general subscription, which was started by the Count's friends among the German people and assisted by inciting proclamations of the German press, resulted in a sum of more than 6,000,000 marks, which were unconditionally put at the disposal of Count Zeppelin. The Count established with this money the "Zeppelin Endowment for the Propagation of Air Navigation," the first enterprise of which was the financing of an airship-building plant, the "Luftschiffbau-Zeppelin" (Zeppelin Airship-Building Company, Ltd.) at Friedrichshafen. The steady development, which began from now on, was carried out under the personal supervision of the old Count Zeppelin by this building company for the engineering sides of the problem, while the "Deutsche Luftschiffahrts-Aktien-Gesellschaft" (German-Airship-Navigation Company) was responsible for the progress of the airship operating science.

ESTABLISH COMMERCIAL SERVICE

The next years of the Zeppelin-development are characterized by the establishment of a commercial airship service by the already mentioned German-Airship-Navigation Co., the "Delag," which made it possible to collect the experience in the operation and construction of ships, indispensable for the purpose of rapid progress and methodical improvements. Some accomplishments of the Count before the beginning of this period (in the year 1909) are, however, worth mentioning. The first is a successful trip to Munich, during which landing and mooring for a night's length in a 40 m.p.h. gale occurred; the other an endurance test, which resulted in a 38 hour non-stop flight, an astonishing performance, considering the time; and the third, a successful flight to Berlin and back, the longest non-stop part of which was 27 hours and during which the ship had to be moored for 3 days in the open field in a storm blowing 45 miles per hour.

The initial experiences of the commercial company, the "Delag," were rather annoying, although not discouraging, the first "*Delag-Airship*," called the "*Deutschland*," being destroyed in 1910, a few weeks after having left the building plant, and the second ship of the same name after a short period of successful operation being so badly damaged in 1911 while being taken out from the shed that it had to be entirely dismantled. But as both cases were clearly recognized as not proving anything against the airships, activities were eagerly continued and in summer and autumn 1911 the passenger-airship "*Schwaben*" firmly established the commercial airship navigation in Germany by an uninterrupted series of more than 140 successful trips throughout the whole territory of Germany. This was the first ship to be equipped with Maybach-Motors, which propelled it with a speed of 43.5 m.p.h., a remarkable accomplishment considering the time.

The commercial service received in the following two years before the war three further ships, the "*Victoria-Luise*," "*Hansa*" and the "*Sachsen*," which altogether performed a total of 1600 successful trips of a total duration of 3,200 hours, in which 35,000 passengers were carried over a distance of nearly 110,000 miles, i. e., more than four times around the equator without the slightest accident to any passenger.

GERMAN ARMY AND NAVY AIRSHIPS

The German army had before the war altogether 8 Zeppelin airships, which were of a very similar type to the commercial ships.

Their principal characteristics were: length 485 ft., diameter 48.5 ft., cubic capacity 660,000 cubic feet, useful load about 8 tons and speed about 47 m.p.h. per second with 3 Maybach motors of 180 h.p. each.

The German Navy ordered its first ship of approximately the same design in winter 1912, which in autumn 1913, after very satisfactory service, was caught in an exceptionally violent atmospheric disturbance in the bight of Heligoland and was lost with the greatest part of the crew. The second navy Zeppelin, the "L-2," completed in 1913, had a cubic capacity of 950,000 cubic ft. with a diameter of 55.5 ft., and a useful load of 11 tons and a speed of 47 m.p.h. This was the first ship to incorporate the interior keel-structure, a novel design, which was afterwards universally adopted. Unfortunately the ventilation system of this ship was not sufficiently adapted to the new arrangement, so that hydrogen gas could enter the engine cars, which caused the burning up of the ship on one of its first flights with the total loss of the crew. In spring 1914 the third navy Zeppelin, the "L-3," was ready. It had a capacity of 790,000 cubic feet, a length of 510 ft., diameter of 48.5 ft., useful load of 9 tons and a speed of 45 m.p.h. It was the only navy airship existing at the start of the war.

With the 25 Zeppelins constructed before the war, the fundamentals of the rigid construction had reached a stage of relative perfection and the Zeppelin war development, which is represented in 90 Zeppelins built within four years, is characterized by a steady increase in the size of the ships on one side and on the other side by incessant improvements and refinements in detail.

The first dozen of war-time ships resembled rather closely the prewar-design with the exception of slight modifications in size and in the rudder arrangement. They were followed by 3 ships of an intermediate type, which had a capacity of 880,000 cubic ft., a length of 525 ft., a diameter of 52.5 and a speed of 51.5 m.p.h. with 3 motors of 210 h.p. The principal change consisted in the definite adoption of the interior keel, which for the first time had already been executed in the Navy Zeppelin L-2, and furthermore for one of the engines the direct drive to the propeller was used, although this made impossible the hitherto well-tried practice of using the propellers, while manœvering on the ground. In April, 1915, a new type came out, which had a capacity of 1,130,000 cubic ft., a length of 536 ft., diameter of 61 ft., a useful load of 14 tons, and a speed of 58 m.p.h. and of which altogether 22 ships were built. An intermediate series of 12 similar ships was constructed during winter 1915-16, which had a capacity of 1,270,000 cubic ft., a length of

586 ft. and a useful load of 17 tons with the same speed. In May, 1916, the first ship of the real Zeppelin war type was ready for flight. It had at first a cubic capacity of 1,950,000 cubic ft., a length of 646 ft., diameter of 75.5 ft., useful load of 29 tons and a speed of 63.5 m.p.h. with 6 motors of 240 h.p. each. Seventeen ships of this type were constructed for the Navy and Army in 1916 and the first month of 1917, during which period considerable constructional improvement was steadily going on and which resulted in a better useful load of 32.5 tons. In spring 1917 the next move was made. By methodically lightening the whole constructional system basing on the available actual experience data of more than 50 ships and by a modification of the engine arrangement together with numerous minor changes a materially improved type was accomplished. The capacity was at the same time slightly increased to 2,000,000 cubic feet, the resulting performances were a useful load of 37 tons to 39 tons, and a speed of 65 to 72.5 m.p.h. with only 5 Maybach motors of an improved supercompressed type. Altogether 21 ships of this type were built from summer 1917 to summer 1918. At this time the next type was ready which had a total length of 695 ft., a diameter of 78.5 ft., capacity of 2,200,000 cubic ft., useful load of 43 tons, which was more than 60% of the total lift. The speed was 81.5 m.p.h. with 7 Maybach motors. Only two ships of this type were built, the Navy Zeppelin L-70 and L-71. The following and last war type of Zeppelins, which was to attain still higher altitudes of much more than 20,000 ft., had a maximum length of 745 ft., a capacity of 2,400,000 cubic ft., useful load of 51.1 tons and a speed of 75 m.p.h. with only 6 motors. It is represented by L-72, afterwards delivered to France, and the L-71, which was subsequently changed to the later model.

FAMOUS FLIGHT TO AFRICA

One special type, the L-59, was constructed in autumn 1917 for a flight from Jamboli, Bulgaria, to German East Africa. It had a capacity of 2,400,000 cubic feet, a useful load of 52 tons and a speed of 65 m.p.h. with 5 motors. The first ship for this special mission, the L-57 having been caught in a violent storm, which made impossible its entering the shed and having been purposely set afire, to prevent promulgation of the secret, another one, the L-59, was rapidly constructed, which performed in November, 1917, its famous flight to Africa and back, which, with its 4500 miles in 96 hours without the slightest trouble of any kind, is still an unbeaten world's record.

After the war in 1919 the Zeppelin company have constructed for well known reasons only two more ships, the small experimental passenger-airships "*Bodensee*" and "*Nordstern*," which maintained a successful commercial service between Berlin and Switzerland, until this also was stopped by the allied powers. These ships had a volume of only 700,000 cubic ft. and 800,000 cubic feet respectively, but twice the useful load and twice the speed than the prewar commercial ships of the same cubic content. Their length was 395 ft. and 430 ft. respectively, diameter 61.5 ft., useful load 11 tons and speed 80 m.p.h.

Altogether the Zeppelin Corporation has constructed from 1900 to 1919, 115 rigid airships, 3 of which were experimental, 9 commercial, 40 Army and 63 Navy airships.

Like the rest of the German aircraft industry, the firms engaged in rigid airship constructions have been crippled by the terms of the Versailles Treaty and the following interpretations by the Allies.

The Zeppelin Firm was forced to deliver the two small commercial airships, the "*Bodensee*" and the "*Nordstern*," which they had built and successfully operated during 1919 to France and Italy, after having been compelled to stop this service together with all construction work during 1920 and 1921. However, they have managed to keep their staff well together and are known to be in serious negotiations with powerful commercial groups in various countries. Their latest move is an arrangement now being almost completed between Spanish commercial interests and the Zeppelin Company to establish an airship service between Spain and the Argentine. They will have ample work for the next year considering the order of the German Government for a modern 70,000 cubic meter commercial ship to be constructed for the U. S. Government with the special permission of the Allies, besides the construction of a small modern special experimental and training ship, which has been started on May 5, 1922, the restrictions of the Allied "peace" terms being partly removed from this date on.

AMERICAN INVESTIGATION CORPORATION

Credit for interesting American capital in commercial airships goes to Fred S. Hardesty and Edward Schildhauer, consulting engineers of Washington, D. C., who brought Dr. Johann Schuette to this country, and, who with Snowden H. Fahnestock, New York banker, enlisted the co-operation of some of the nation's foremost financial and industrial men in forming, first, the American Investigation Corporation, and, later, the General Air Service. The Ameri-

can Investigation Corporation is capitalized for 5000 shares, no par value, under the laws of the State of Maryland. General Air Service is incorporated under the laws of the State of Maryland with stock of no par value.

The following are the directors and officers of the American Investigation Corporation: S. Reading Bertron, Benedict Crowell, William M. Clark, Snowden A. Fahnestock, William B. Joyce, General W. L. Kenly, Samuel McRoberts, Franklin Remington, Franklin D. Roosevelt, Colonel William Thaw. Officers: President, Mr. Fahnestock; Vice-Presidents, Francis T. Homer and Mr. Roosevelt; Secretary, Alvin Devereux; Treasurer, John F. O'Meara.

The American Investigation Corporation is proceeding on comprehensive yet conservative lines. Among those who have subscribed to this significant preliminary endeavor are: From New York: S. Reading Bertron, Berton, Griscom & Co., Inc.; Edward H. Clark, President, Homestake Mining Co.; Lewis L. Dunham, President, Equitable Building Co.; Snowden A. Fahnestock, President, American Investigation Corp.; David M. Goodrich, Goodrich, Lockhart & Co.; William B. Joyce, President, National Surety Co.; J. R. Lovejoy, Vice-President, General Electric Co.; Samuel McRoberts, President, Metropolitan Trust Co.; Rudolf Pagenstecher, Director, International Paper Co.; Theodore Pratt; Franklin Remington, President, Foundation Co.; Franklin D. Roosevelt, Attorney, ex-Ass't Sec. of the Navy; R. T. Wilson & Co., Bankers; O. D. Young, Chairman, Radio Corporation of America. From Pittsburgh: Taylor Alderice, Vice-President, National Tube Co.; Geo. W. Crawford, President, Ohio Fuel Supply Co.; Arthur V. Davis, President, Aluminum Co. of America; E. M. Herr, President, Westinghouse Electric & Mfg. Co.; W. H. R. Hilliard, Banker; James H. Lockhart, Vice-President, Lockhart Iron & Steel Co.; J. R. McCune, President, Union National Bank; H. C. McEldowney, President, Union Trust Co.; R. B. Mellon, President, Mellon National Bank; W. L. Mellon, President, Gulf Oil Co.; E. W. Mudge, President, Edmund W. Mudge Steel Co.; Wilson A. Shaw, Chairman of Board, Bank of Pittsburgh; Benjamin Thaw, Retired banker. From Chicago: John D. Black, Attorney, Winston, Strawn & Shaw; A. L. Drum, Consulting Engineer; Marshall Field, Marshall Field, Grove, Ward & Co.; C. Bai Lihme, President, Lihme Zinc Co.; Hampden Winston, Real Estate; Philip N. Wrigley, Vice-President, Wrigley & Co. From Washington: Ira E. Bennett, Editor, "The Washington Post"; Lieut. Col. C. de F. Chandler, ex-Chief Balloon Section, U. S. Army, A. E. F.; Lieut. Col. Clarence C. Culver, U. S. Army; Fred S. Hardesty, Consulting Engineer; William E. Richardson, Attorney; Edward

Schildhauer, Consulting Engineer. From Cleveland: Chester C. Bolton, Banker; Charles T. Brooks, Attorney; Benedict Crowell, ex-Ass't Secretary of War; L. C. Hanna, Jr., M. A. Hanna Company; John A. Penton, President, Penton Publishing Co.; Andrew Squire, Attorney. From Philadelphia: Robert K. Cassatt, Cassatt & Co., Bankers; Samuel F. Houston, Real Estate Trust Building. From Paris, France: Laurence V. Benet, President, Hotchkiss Company. From Seattle, Wash.: W. E. Boeing, President, Boeing Airplane Co. From Erie, Pa.: Otto Hitchcock, Hays Company; John R. McDonald, President, First National Bank. From Birmingham, Ala.: Crawford Johnson, President, Coca Cola Bottling Co. From Ponca City, Okla.: E. W. Marland, President, Marland Oil Co.; General W. L. Kenly, Marland Oil Co. From Houston, Texas: John H. Kirby, President, Kirby Lumber Company. From Bloomington, Ill.: Lewis G. Stevenson, Vice-President, McLean County Coal Co.

SCHUETTE-LANZ DEVELOPMENT

The first Schuette-Lanz airship, the S.L.-1, made its initial flight Oct. 17, 1911. For more than two years she was in regular service, making 65 flights, covering 6827 miles, and carrying 3304 passengers. Following S.L.-1, twenty-one other Schuette-Lanz airships were built, all for the use of the German imperial forces during the war. These Schuette-Lanz ships contained extraordinary developments which have become the characteristics of all rigid airships throughout the world, according to Mr. Schildhauer, consulting engineer for the American Investigation Corporation. These fundamental characteristics were built into the first two ships of the type and are: streamline form; suspended cars and power eggs, side-hung cars, direct drive propeller, reversible propeller, plane surface stabilizers, plane surface rudders and elevators, inside walks, central stiffening cable, gas shafts between gas bags, electrical telephone and telegraph signals for engine room and navigating room controls, complete electrical equipment including electric power station. It is this latter type of airship containing these fundamental characteristics the patents for which and the engineering data covering all computations for construction and operation of which the American Investigation Corporation purchased.

According to Mr. Schildhauer, the design and construction of commercial rigid airships for present-day traffic depends, of course, upon the sum total of previous experience in designing and constructing ships for previous commercial, military and naval use, military ships having been designed on a basis of every ounce of useful load

being given over to armament and fuel, for long-distance radius of action necessarily confined to the framework of such ships to the very least possible, even to the extent of taking some risk, which risk will be precluded in the design and construction of commercial ships. Old types of frame-work of wood and flat duraluminum are now replaced by duraluminum tube construction which gives for greater rigidity for the same weight and size of member, and permits of intermediate bracing practically impossible with thin flat shapes. Design, of course, embraces passenger quarters and freight and express handling rooms, which were not necessary on military craft. These quarters are luxurious, attached to the frame of the ship, making for rigidity and stability, and are so arranged that noise, fumes and discomforts of any kind are impossible. Sanitary arrangements are perfect, dining service is adequate, and lounging and smoking rooms assure comfort during daytime while luxurious sleeping quarters insure restful night travel.

TYPES OF AIRSHIPS TO BE USED

On various routes the requirements will, of necessity, call for ships of varying size and capacity. On a route such as that from New York to Chicago, the ships of General Air Service will be of about 3,350,000 cubic feet capacity, contained in 20 or more balloonets. This will make a ship 750 feet long and 97 feet in diameter, constructed of cold-riveted tubes. Such a ship would have 10 standard 300 h.p. engines and the net carrying capacity utilizing helium as the lifting gas will be sufficient to transport between New York and Chicago 100 passengers and baggage and 60,000 lbs. freight. Ships for transoceanic service would necessarily require an increase in size to 5,000,000 and 7,000,000 cubic feet. This would be necessary in order to carry greater paying loads and increase fuel capacity for cross-ocean flights. Designs now completed for the type of ship that General Air Service will put into commission for trans-Atlantic service will be ships 900 feet long, 114 feet in diameter with a gas capacity of 5,297,490 cubic feet and a passenger capacity of 100, while ships for South American traffic will be 977 feet long, 126 feet in diameter with a gas capacity of 7,240,600 cubic feet, to accommodate 100 passengers. The horse-power of the Atlantic cruiser will be 3900, and of the South American ship, 5400. The cruising speeds of all ships of this company will be 75 m.p.h. with a maximum speed of 100 m.p.h.

Plans for the immediate future are the completion of the organization of General Air Service, the organization of a company to

build the airships—General Air Service being an operating company only—the acquirement and building of terminal facilities along the selected route, the building of three ships in order to have a ten-hour service every day, each way, between New York and Chicago, and the establishment of research and experimental laboratories for perfecting the apparatus to handle helium gas and the production of new alloys for metal parts, and the general perfection of all construction and operating equipment which shall add to the safety, reliability and length of service of the rigid airships of the company. Full coöperation will be maintained with all Government departments interested or having to do with aeronautical matters.

HISTORICAL DESIGN SECTION

INDEX

(For Historical Models 1900-1920 inclusive, see "Aircraft Year Book, 1921.")

AIRCRAFT

	PAGE
Aeromarine Passenger Flying Boat, Model 50-2	123
Aeromarine Passenger Flying Boat, Model 50-L	124
Airship Mfg. Co. of America Towing Dirigible	125
American Investigation Corp. Commercial Dirigible.....	126
Cox-Klemin Amphibian Passenger Type, Model C. K.-1	127
Curtiss Naval Torpedo Plane, Model C.-T.	128
Curtiss Triplane Racer	129
Curtiss-Navy Racer	130
Dayton Wright Chummy Training Type, Model T. A.-3	131
Dayton Wright Photographic Type, Model F. P.-2	132
Elias Commercial Type, Model E. S.-1.	133
Goodyear Military Airship	134
Huff Daland 3-Place Commercial Type, "Petrel" Model	135
Laird "Swallow"	136
Lewis and Vought Shipboard Type, Model V. E.-7-F.	137
Loening Air Yacht, Model 23	138
Remington-Burnelli Airliner	139
Lawrence Sperry Sport Type, Curtiss J. N. with Sperry Monoplane Wing.	140
Thomas-Morse M. B.-7	141

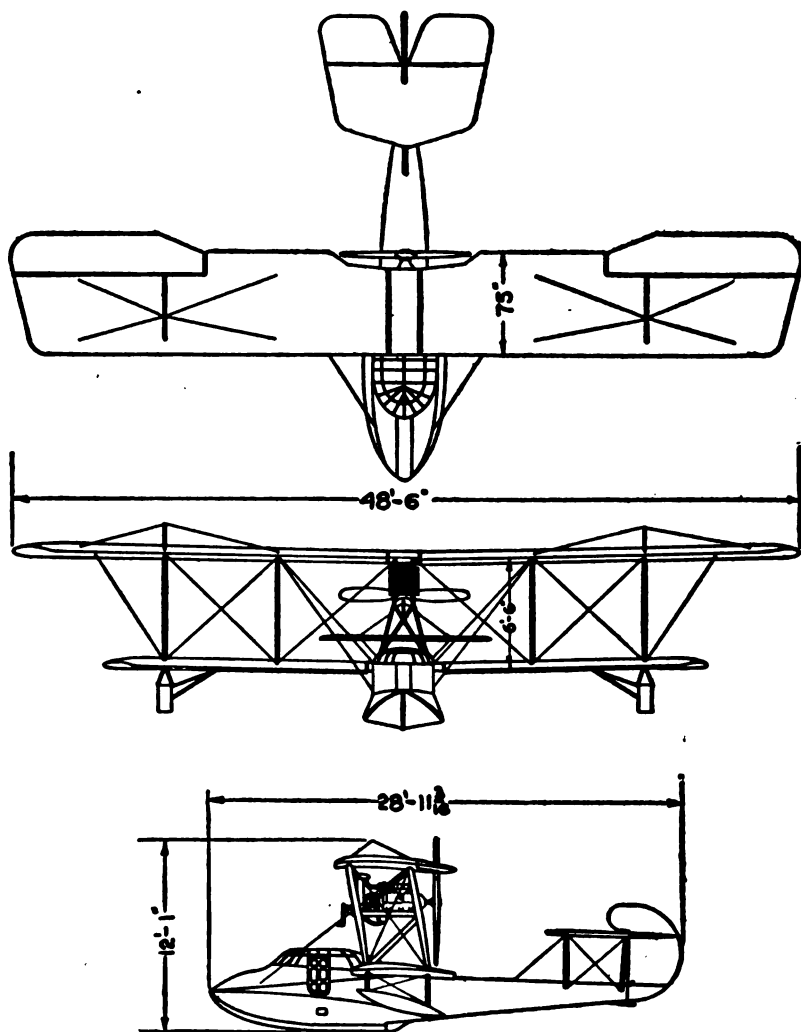
ENGINES

Historical

Original Wright Brothers Engine of 1903.....	142
Glenn H. Curtiss Model L, Winner of Gordon Bennett Race, 1909.....	143
Thomas Aeromotor Company (Thomas-Morse)	144

Recent Developments

Aeromarine U-8-D	145
Aeromarine U-873	146
Curtiss C-6	147
Curtiss D-12	148
Lawrance J-1	149
Packard 1a825	150
Packard 1a1237	151
Packard 1a2025	152
U. S. Air Service Liberty-12-A	153
U. S. Air Service W-1	154
Wright E-3	155
Wright T-2	156
Wright R-1	157
Wright D-1	158
Wright Type 4.....	159

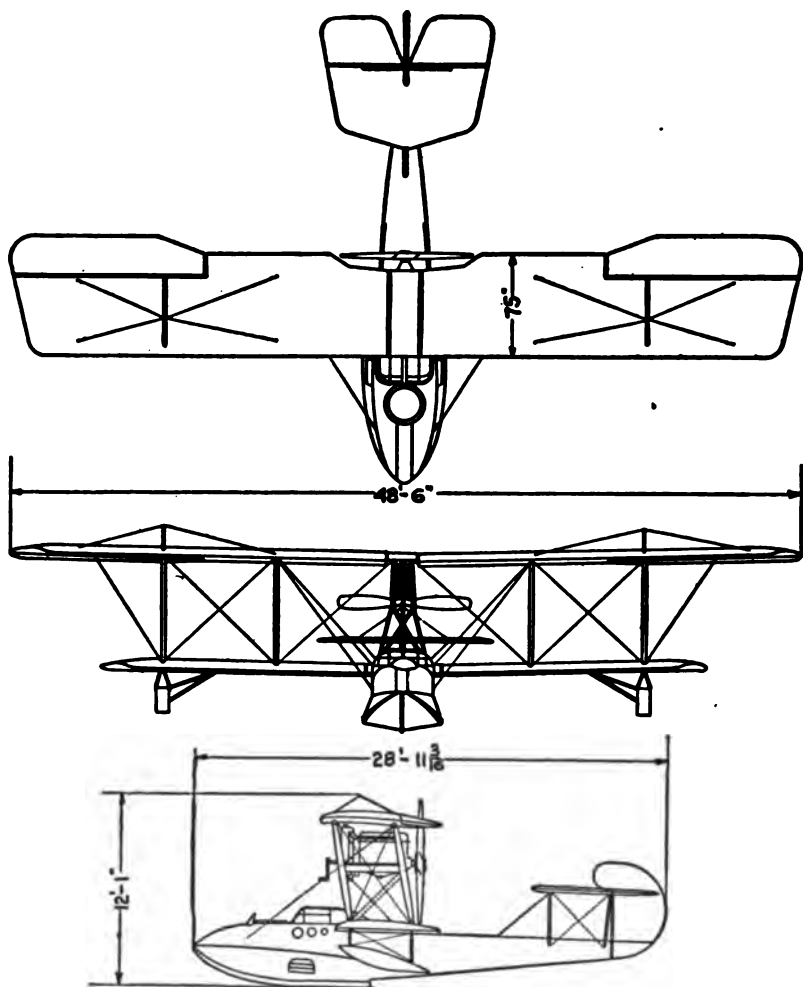


AEROMARINE PLANE & MOTOR COMPANY

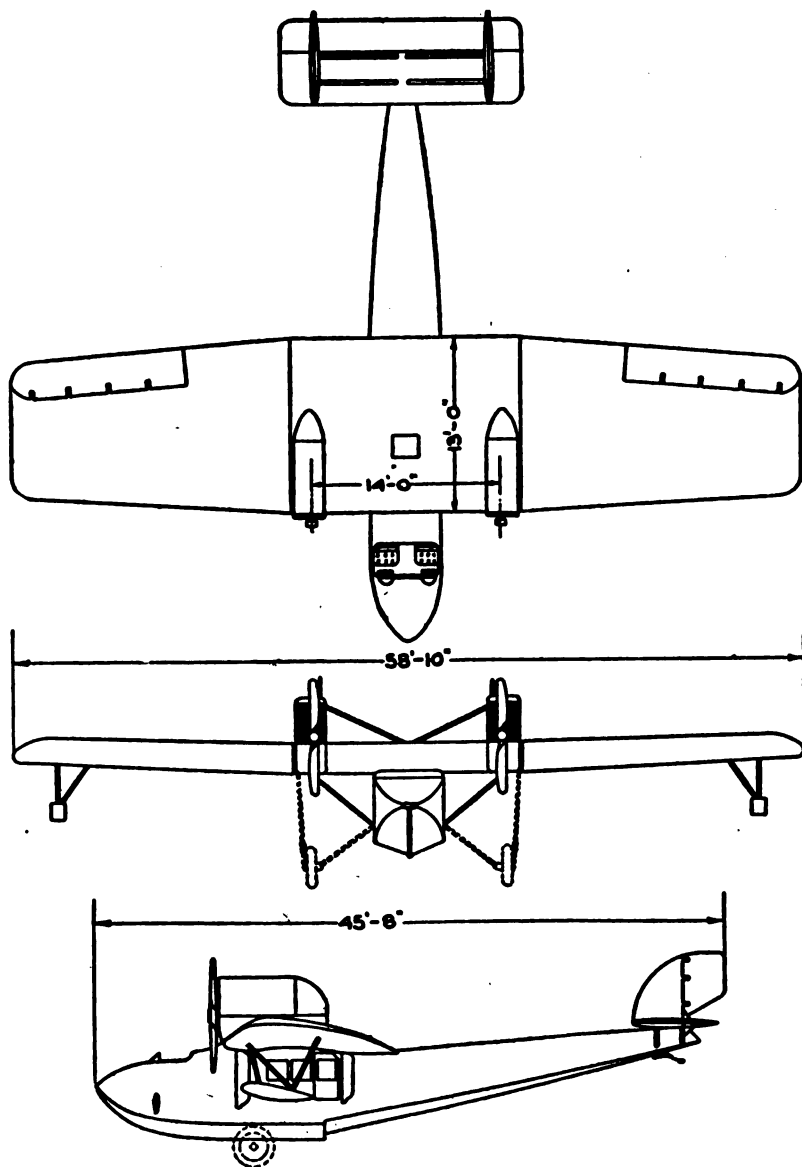
KEYPORT, N.J.

TYPE: FLYING BOAT, PASSENGER

MODEL: 52-U8D



AEROMARINE PLANE & MOTOR COMPANY
KEYPORT, N. J.
TYPE: FLYING BOAT, PASSENGER MODEL:: 50 - USD.



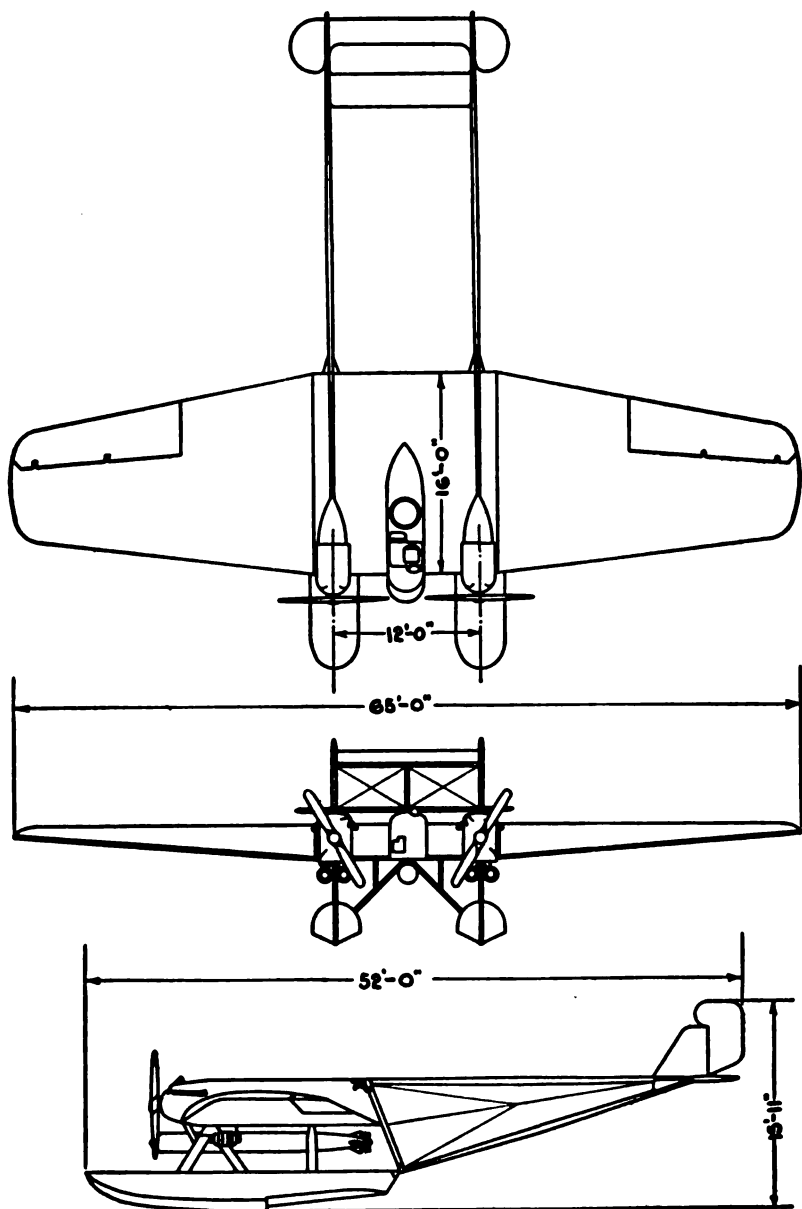
COX-KLEMIN AIRCRAFT CORPORATION

COLLEGE POINT, L.I., N.Y.

TYPE: PASSENGER, AMPHIBIAN

MODEL: CK-1

ENGINES: TWO ISOTTA-FRASCHINI, 275 H.P. EACH, SPEED: 50-117 M.P.H., SERV. CEIL: 11000 FT.



CURTISS AEROPLANE & MOTOR CORPORATION

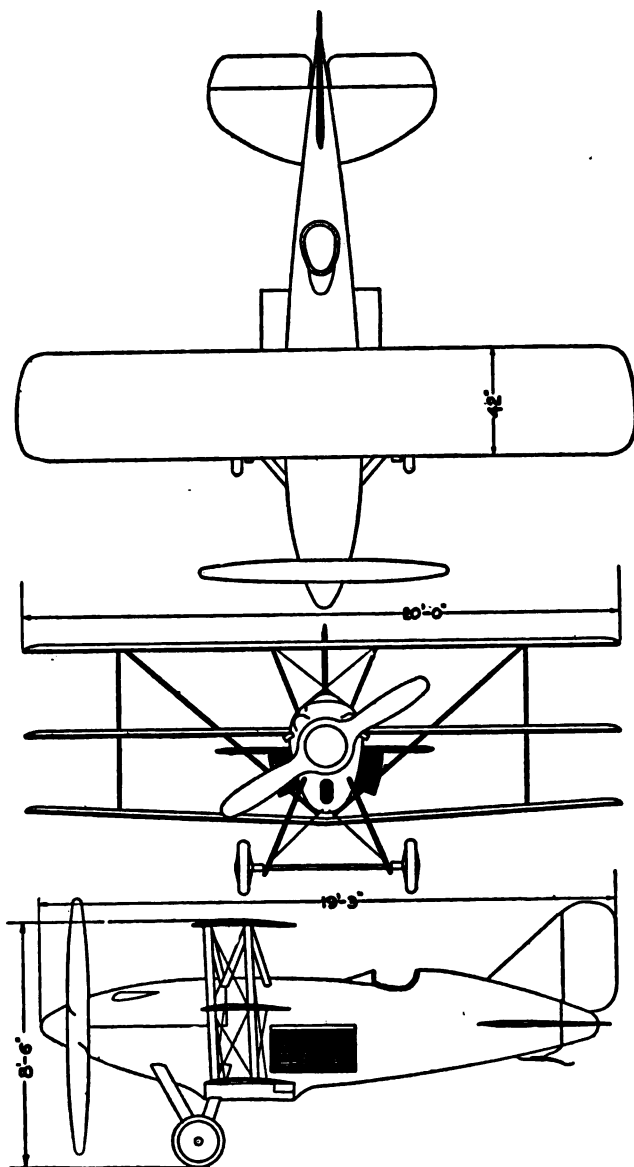
GARDEN CITY, L.I., N.Y.

TYPE: NAVAL TORPEDO PLANE

MODEL: C-7

ENGINES: TWO CURTISS CD-12 400 H.P. EACH

SPEED: 112 M.P.H.



CURTISS AEROPLANE & MOTOR CORPORATION

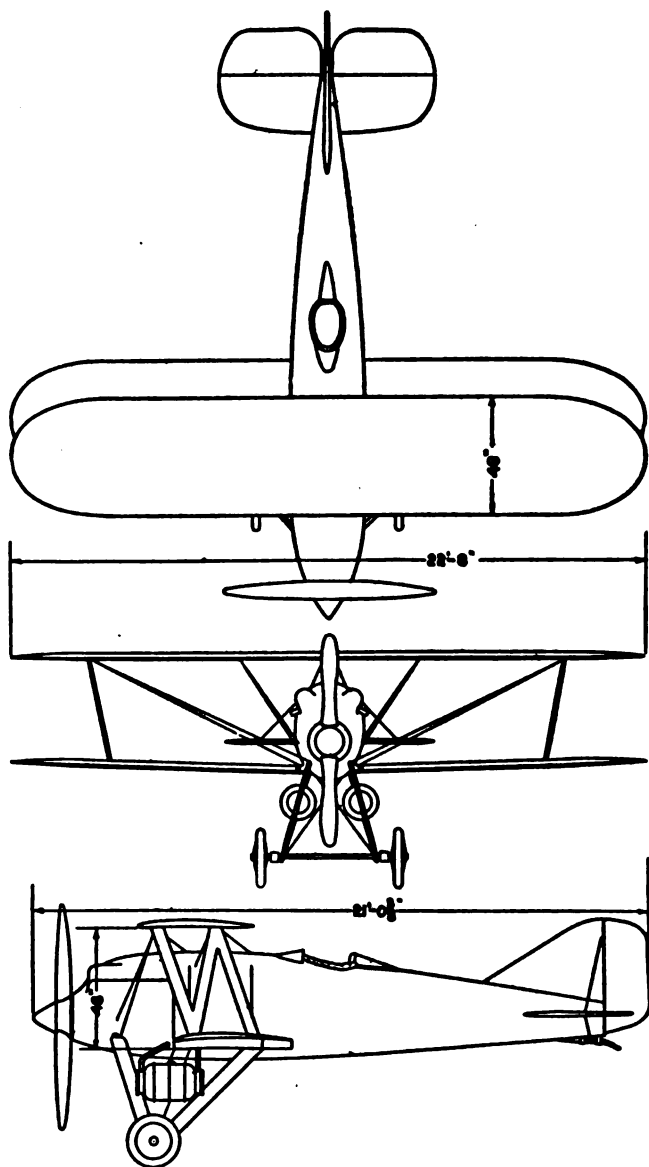
GARDEN CITY, L.I., N.Y.

TYPE: RACER

MODEL: WILDCAT

ENGINE: CURTISS C-12 435 H.P.

SPEED: 70-196 M.P.H.



CURTISS AEROPLANE & MOTOR CORPORATION

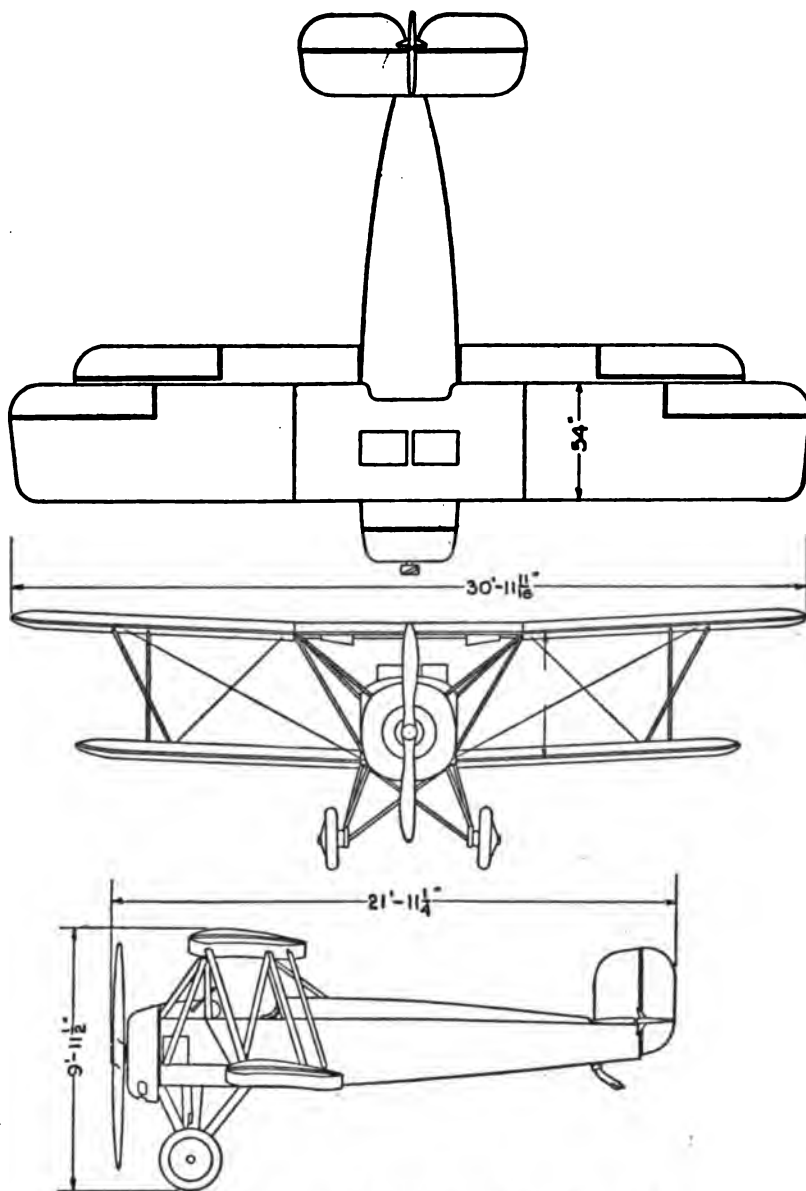
GARDEN CITY, L.I., N.Y.

TYPE: RACER

MODEL: CURTISS NAVY RACER

ENGINE: CURTISS CD-12- 400 H.P.

SPEED: 70-190 M.P.H.



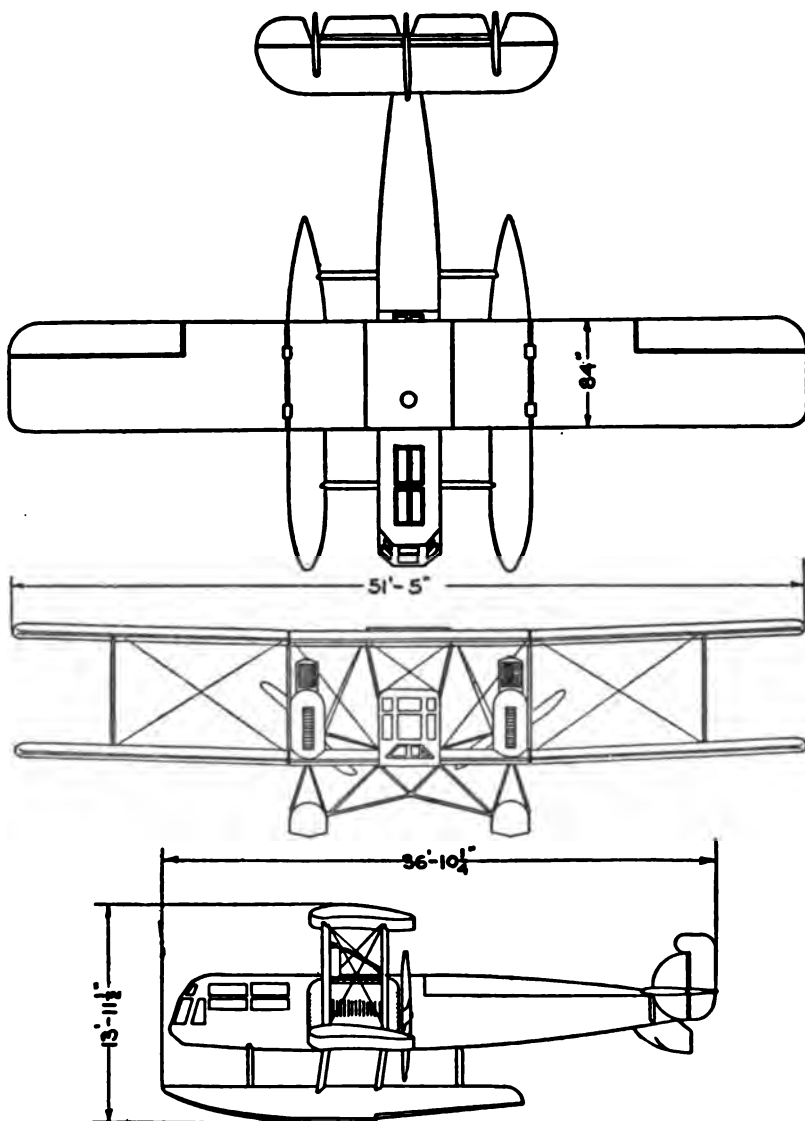
DAYTON WRIGHT COMPANY

DAYTON, OHIO

TYPE: 'CHUMMY' TRAINING

MODEL: TA-3

ENGINE: LE RHONE 80 H.P.

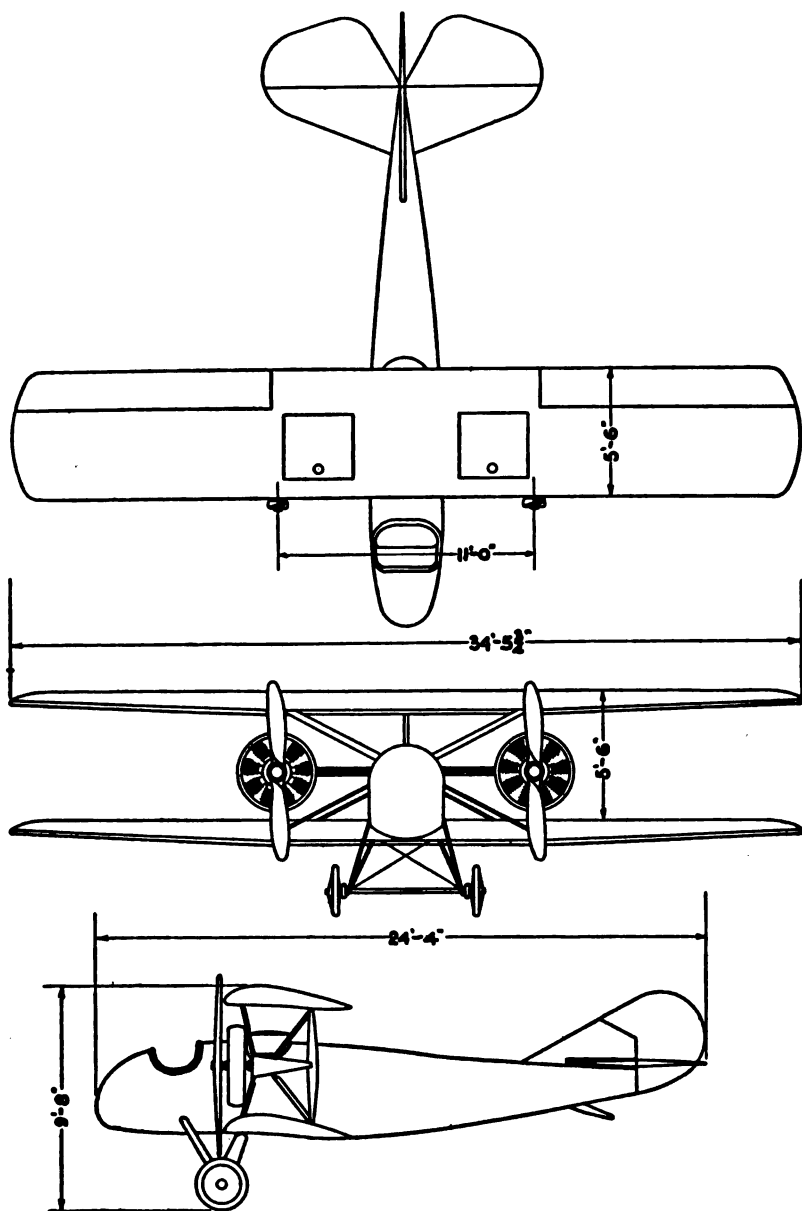


DAYTON WRIGHT COMPANY
DAYTON, OHIO

TYPE: PHOTOGRAPHIC

MODEL: FP-2

ENGINES: TWO LIBERTY, 420 H.P. EACH. SPEED: 63-120 M.P.H. CLIMB: 5000 FT. 10 MIN.



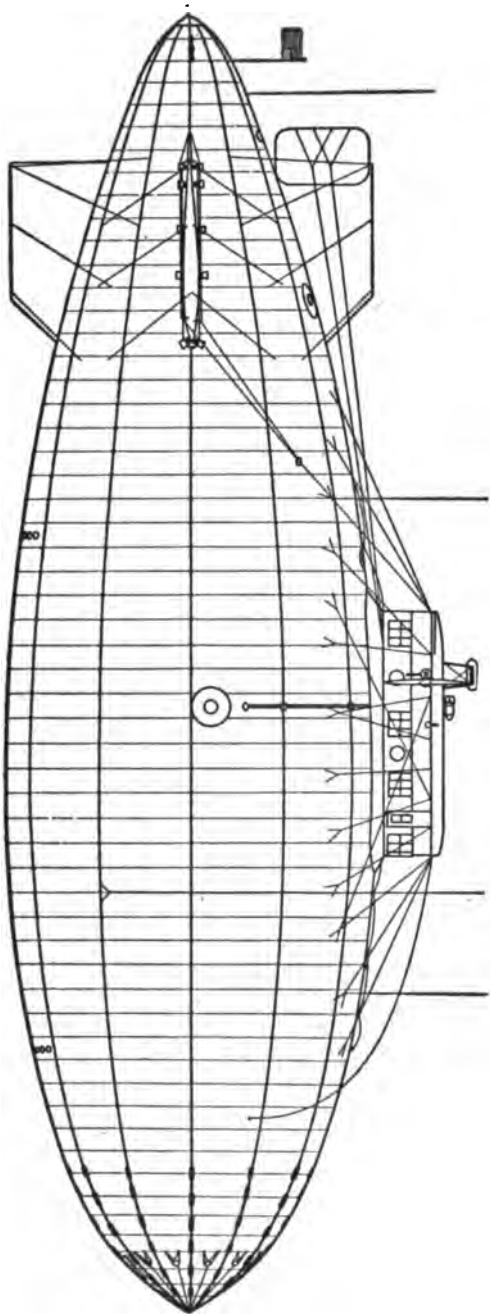
G. ELIAS & BRO. INC.
BUFFALO, N.Y.

TYPE: COMMERCIAL

ENGINE: TWO LE RHONE 80 H.P. EACH

MODEL: ES-1

SPEED: 90 M.P.H.

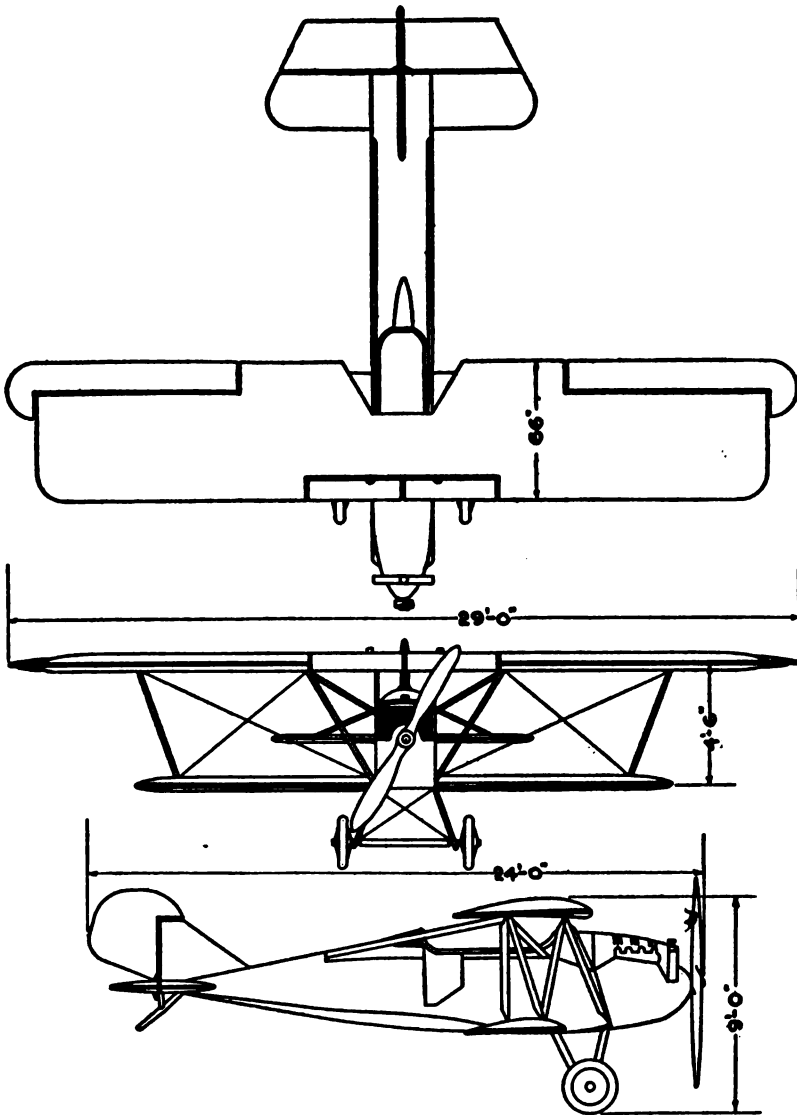


GOODYEAR TIRE & RUBBER COMPANY

AKRON, OHIO

GOODYEAR MILITARY AIRSHIP

ENGINES: TWO AEROMARINE 125 H.P. EACH LENGTH: 169.2 FT. BEAM: 48 FT. VOL.: 185,000 CU. FT.



HUFF DALAND AND COMPANY

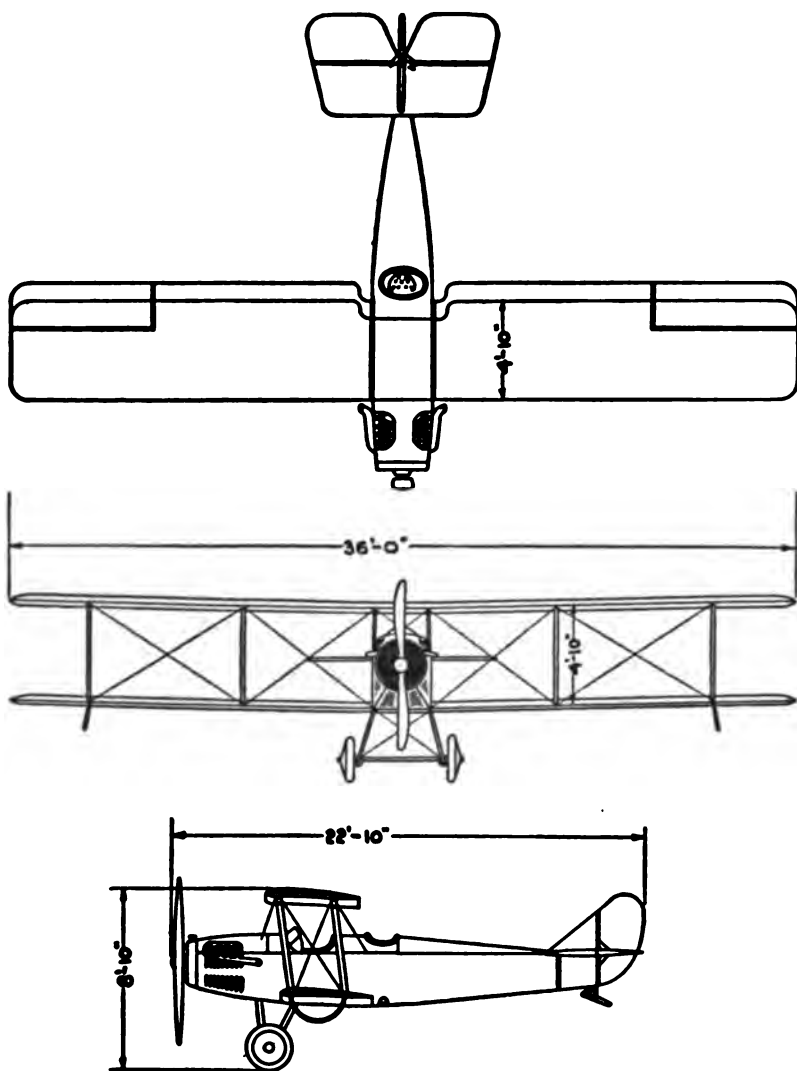
OGDENSBURG, N.Y.

TYPE: 3 PLACE COMMERCIAL

MODEL: "PETREL"

ENGINE: OX-5 90 H.P.

SPEED: 90 M.P.H.



E. M. LAIRD COMPANY
WICHITA, KAN.

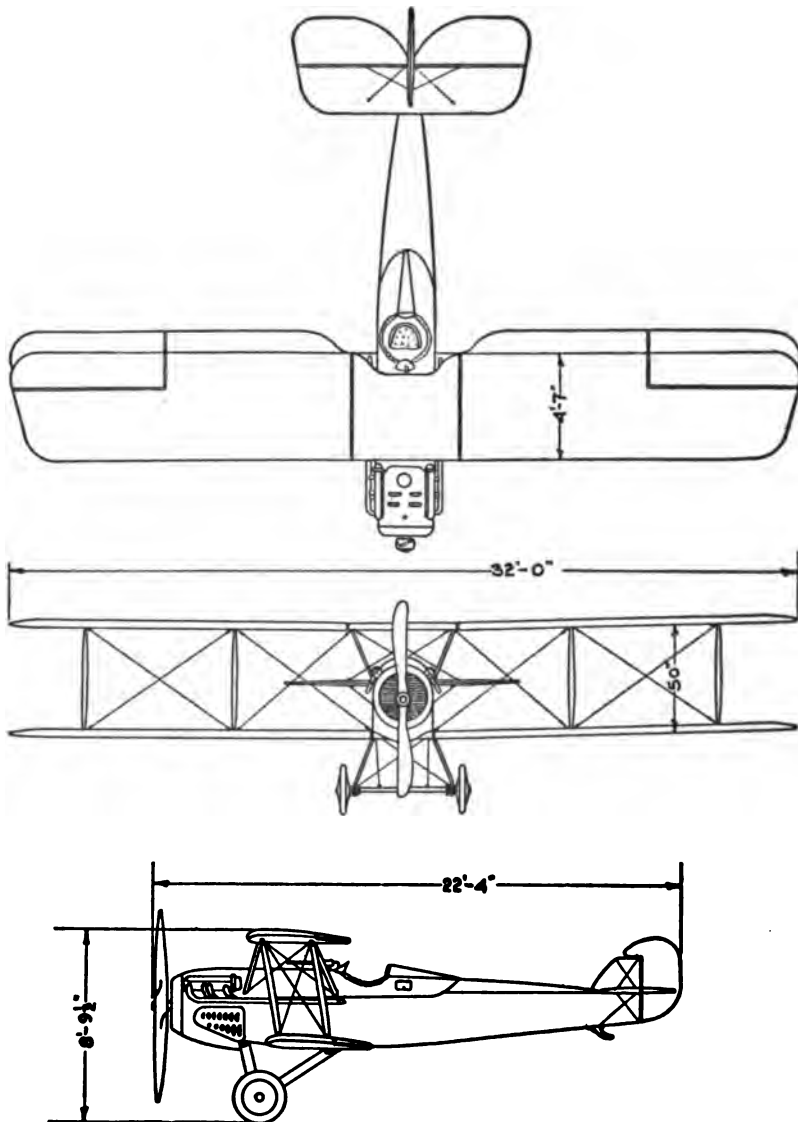
TYPE: PASSENGER

MODEL: SWALLOW

ENGINE: OX-5 90 H.P.

SPEED: 38-84 M.P.H.

CEILING: 17,000 FT.



LEWIS & VUGHT CORPORATION

LONG ISLAND CITY, N.Y.

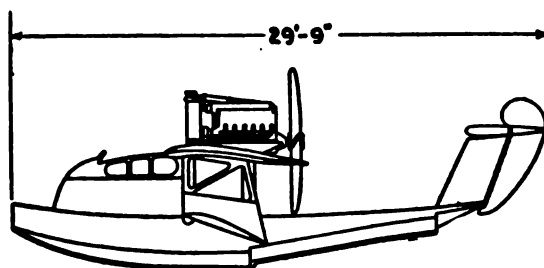
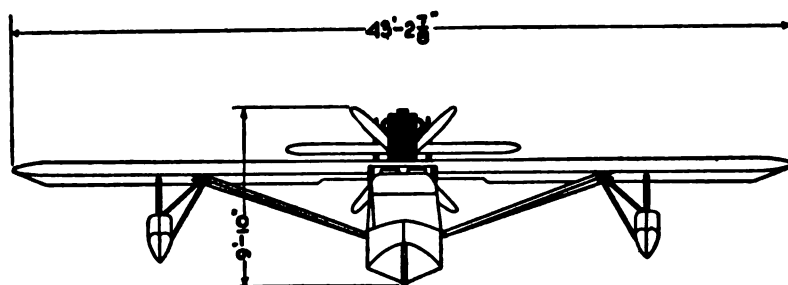
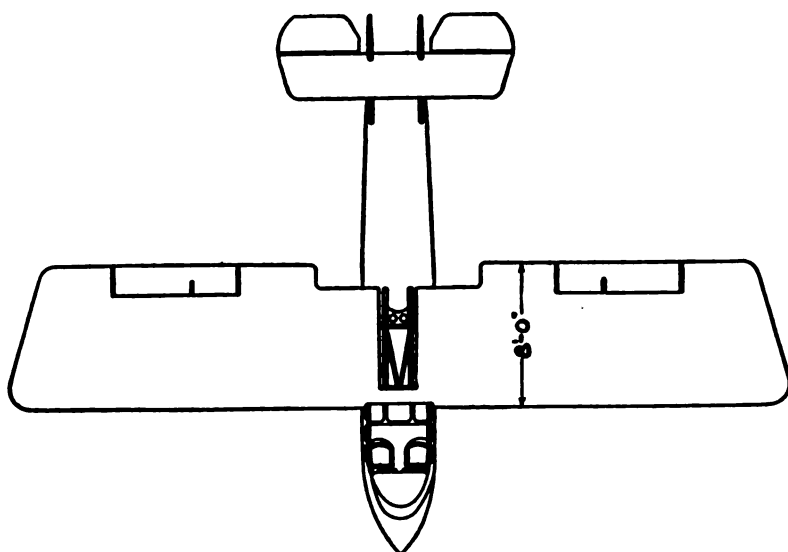
TYPE: SHIPBOARD

MODEL: VE-7F

ENGINE: WRIGHT 190 H.P.

SPEED: 131 M.P.H.

CLIMB: 10,000 FT. in 12 min. 10 sec.

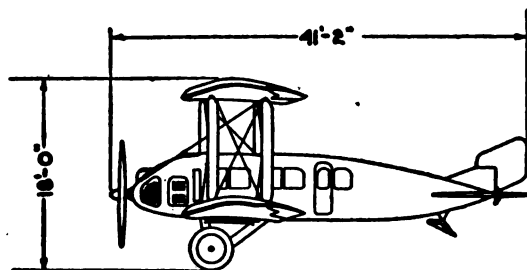
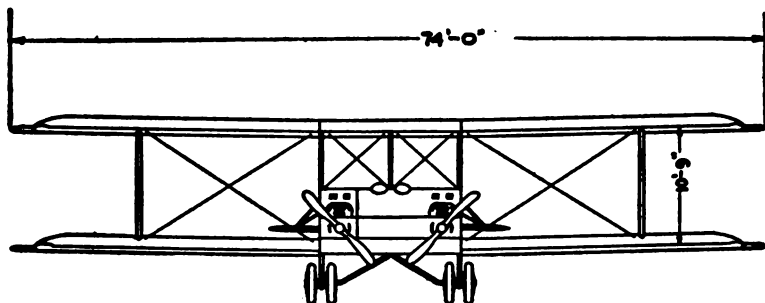
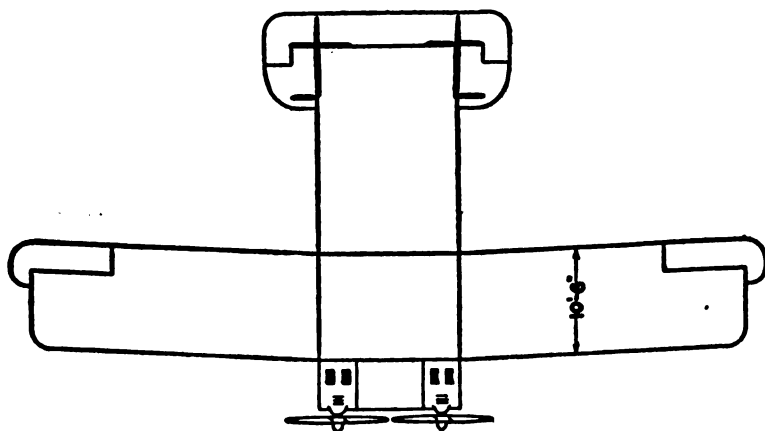


LOENING AERONAUTICAL ENGINEERING CORPORATION
NEW YORK, N.Y.

LOENING AIR YACHT

MODEL: 23

ENGINE: LIBERTY 12 400 H.P. SPEED: 135 M.P.H. CLIMB: 10,000 ft 10 min



REMINGTON-BURNELLI COMPANY

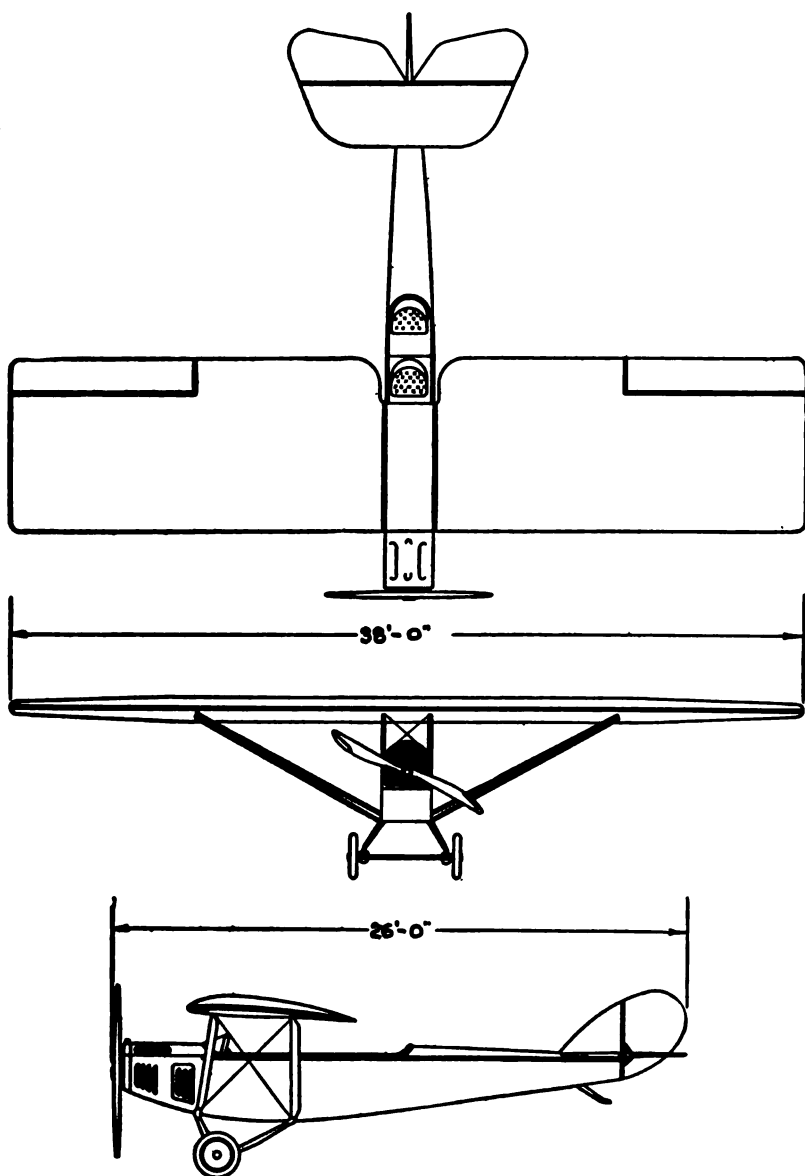
AMITYVILLE, L.I., N.Y.

TYPE: COMMERCIAL

REMINGTON-BURNELLI AIRLINER

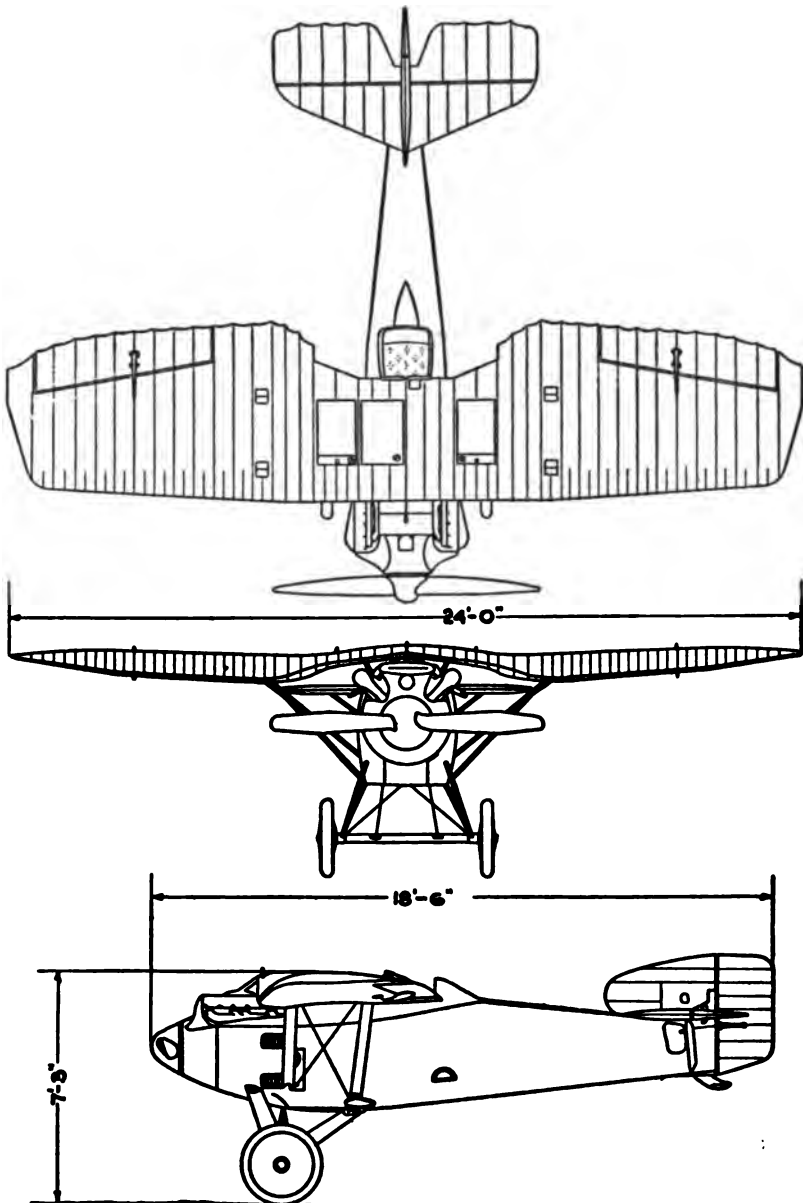
ENGINES: TWO 600 H.P. EACH

SPEED: 50-110 M.P.H. CLIMB: 900 FT. FIRST MIN.



LAWRENCE SPERRY AIRCRAFT COMPANY INC.
FARMINGDALE, L.I. N.Y.

TYPE: SPORT MODEL: CURTISS JN WITH SPERRY MONOPLANE WING
ENGINE: OX 90 H.P. OR OXX 110 H.P. SPEED: 35-80 OR 37-85 M.P.H. CLIMB: 3000 FT. 10 MIN.

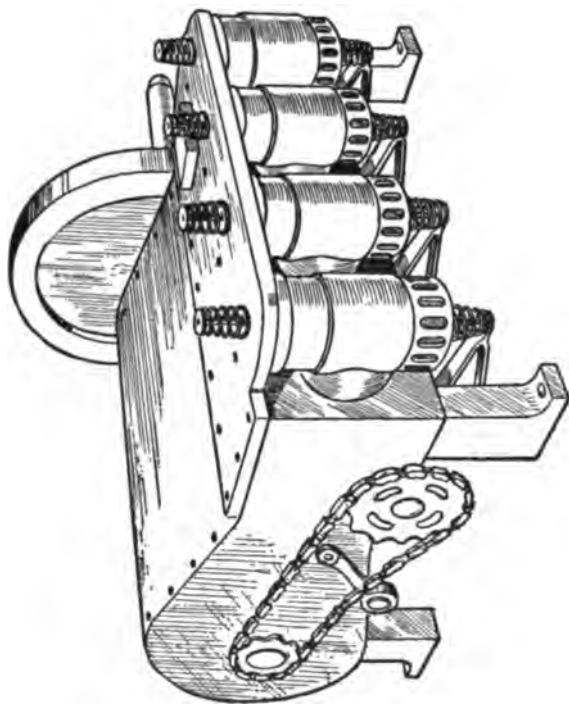


THOMAS-MORSE AIRCRAFT CORPORATION

ITHACA, N.Y.

MODEL: MB-7

141



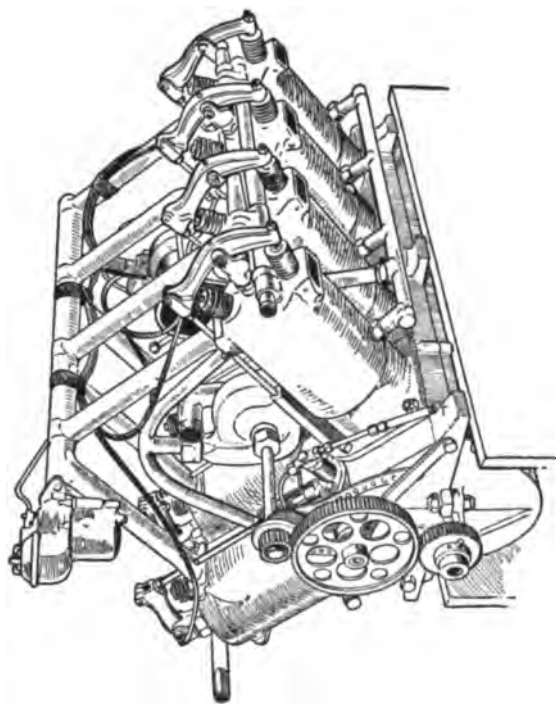
HISTORIC ~ WRIGHT BROTHERS ~ DAYTON. O.

MODEL : ORIGINAL WRIGHT 4 CYLINDERS WATER COOLED

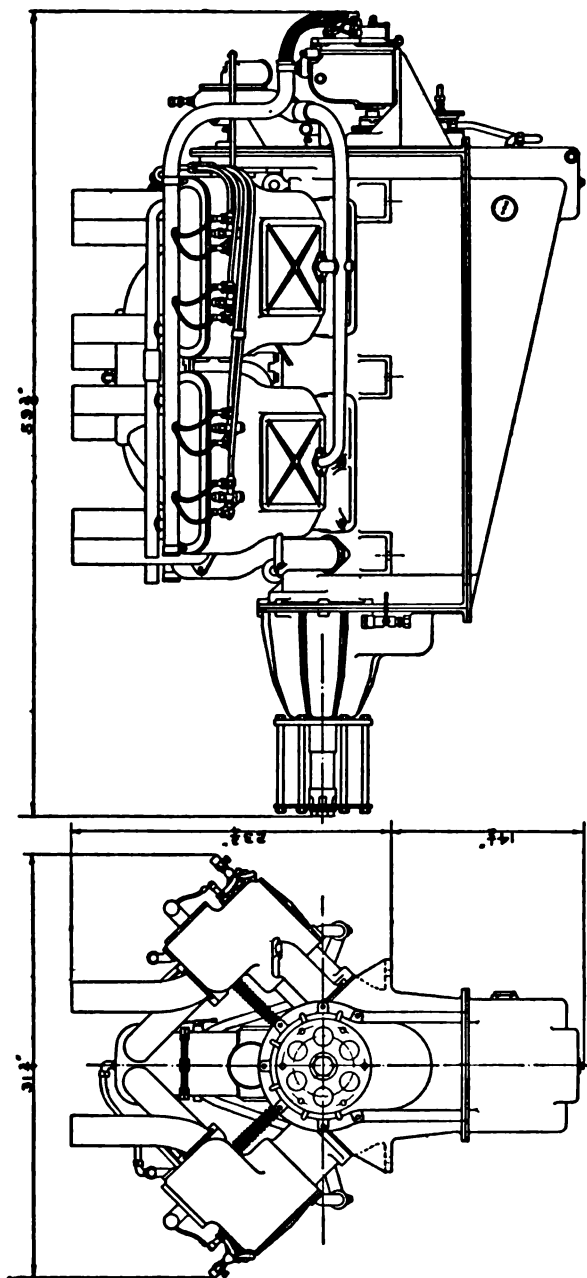
12 B.H.P. AT 1200 R.P.M.

170 LBS. DRY

ENGINE USED IN FIRST FLIGHTS ~ KITTY HAWK, N.C. ~ DEC., 1903



HISTORIC ~ GLENN H. CURTISS ~ HAMMONDSPORT, N.Y.
MODEL: L 8 CYLINDERS WATER COOLED
50 B.H.P. AT 1200-1500 R.P.M. 250 LBS. DRY
ENGINE USED IN WINNER OF RHEIMS RACE, FRANCE ~ 1909

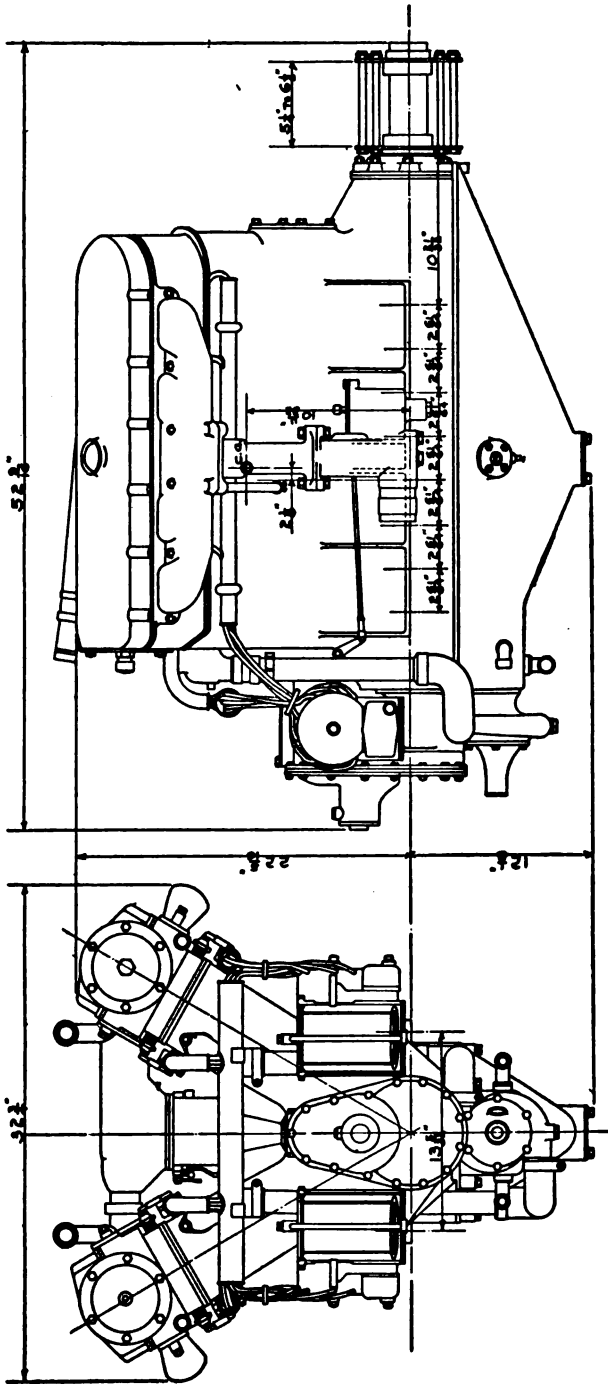


HISTORIC ~ THOMAS AEROMOTOR COMPANY ~ 1915

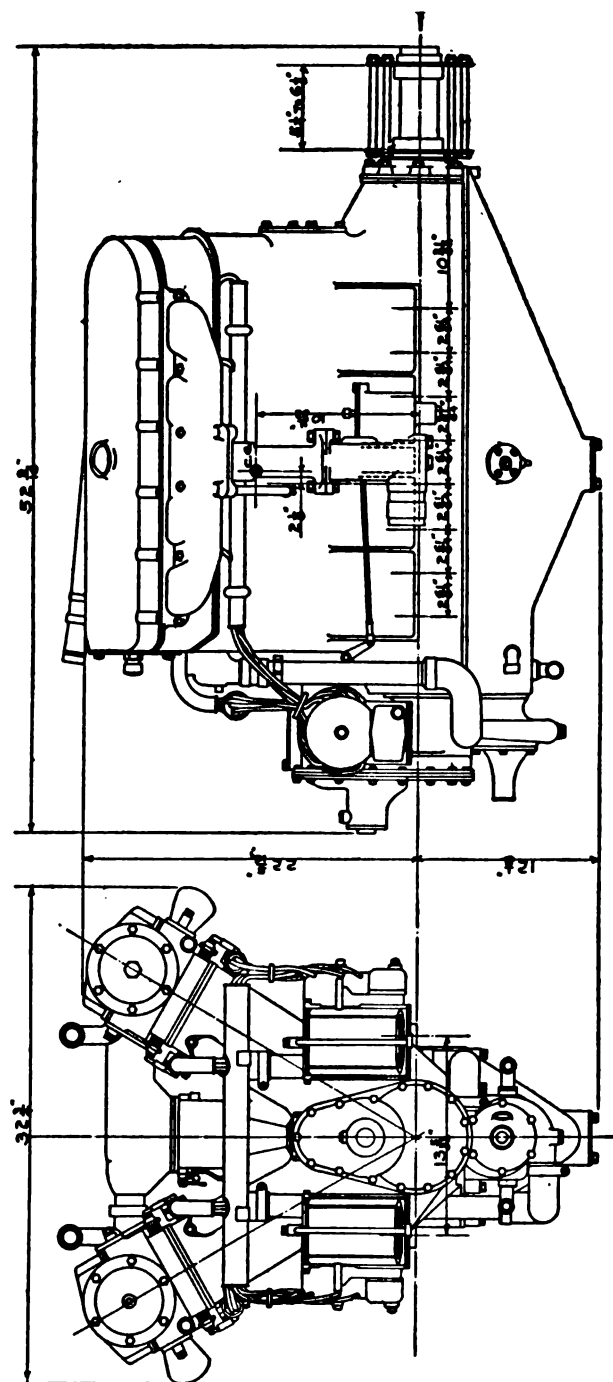
(THOMAS-MORSE AIRCRAFT CORPN., SUCCESSORS ~ ITHACA, N.Y.)

MODEL: 8 8 CYLINDERS WATER COOLED

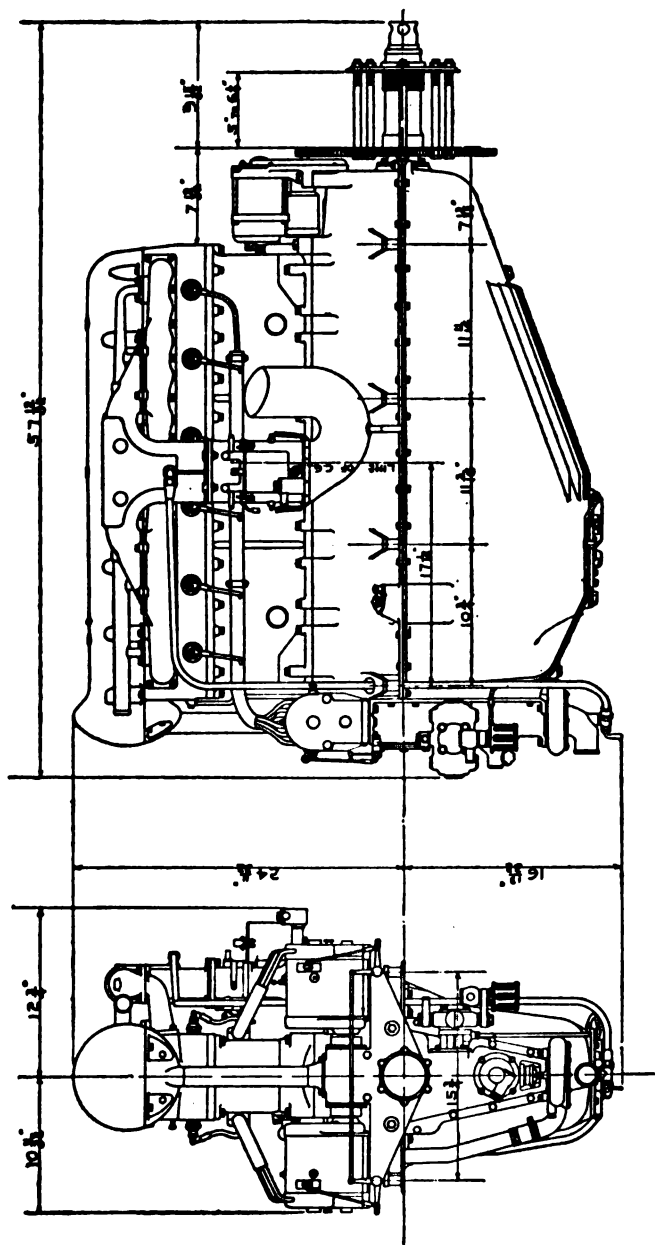
135 B.H.P. AT 2000 R.P.M. 600 LBS. DRY



AEROMARINE PLANE & MOTOR COMPANY~KEYPORT, N.J.
 MODEL: U-8-D 8 CYLINDERS WATER COOLED
 220 B.H.P. AT 1800 R.P.M. 590 LBS. INCL. WATER

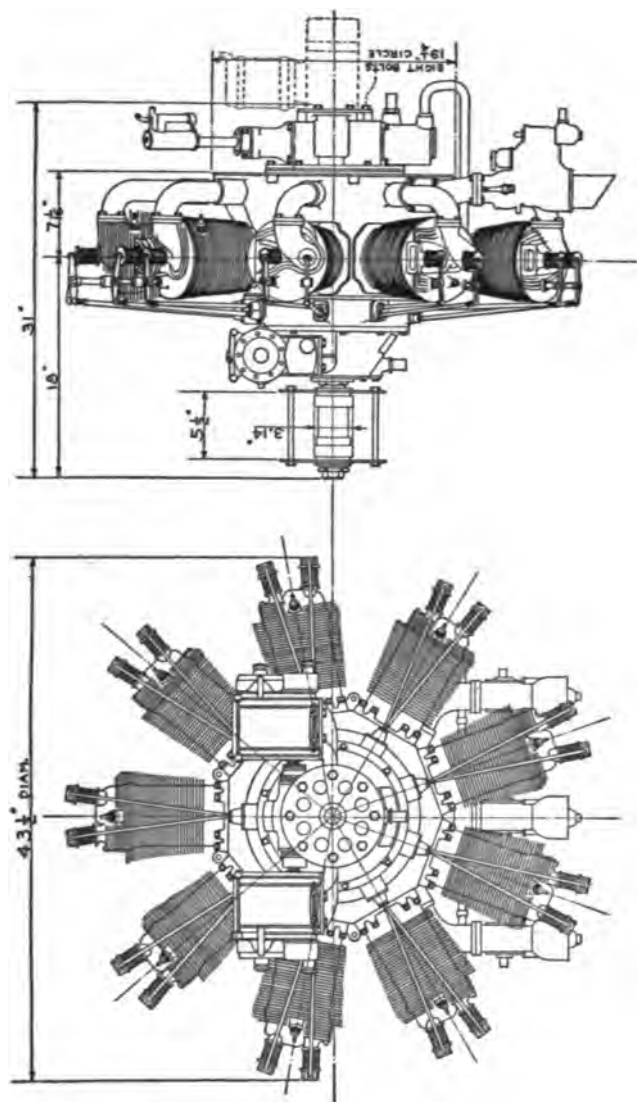


AEROMARINE PLANE & MOTOR COMPANY~KEYPORT, N.J.
MODEL: U-873-PURSUIT-TYPE 8 CYLINDERS WATER COOLED
260 B.H.P. AT 1800 R.P.M. 549 LBS. INCL. WATER

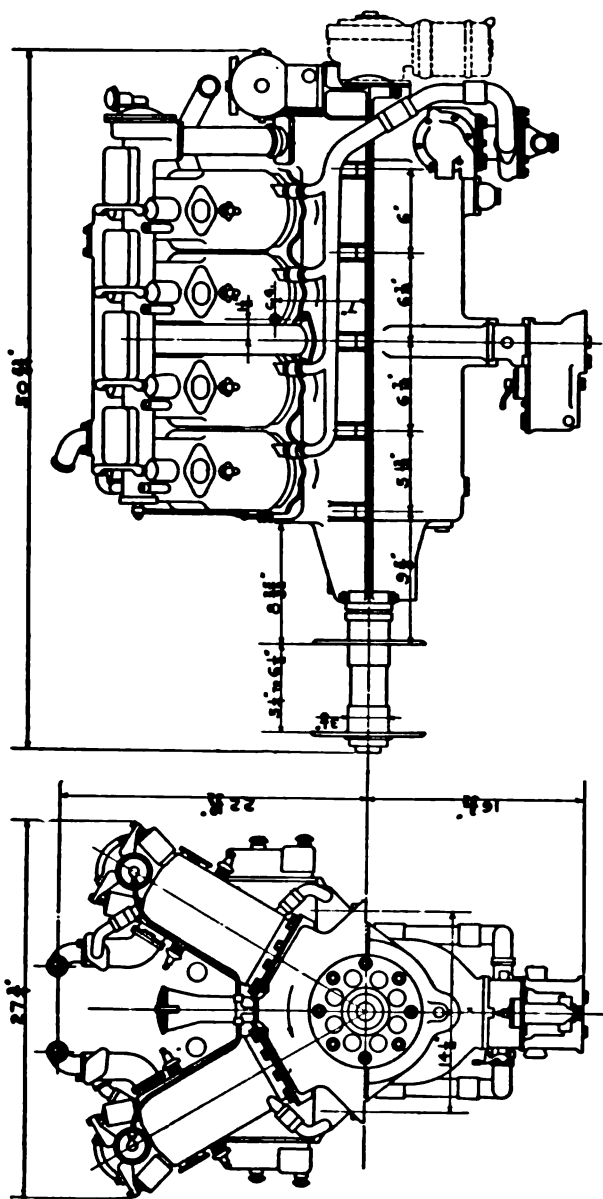


CURTISS AEROPLANE & MOTOR CORPN. ~ GARDEN CITY, N.Y.

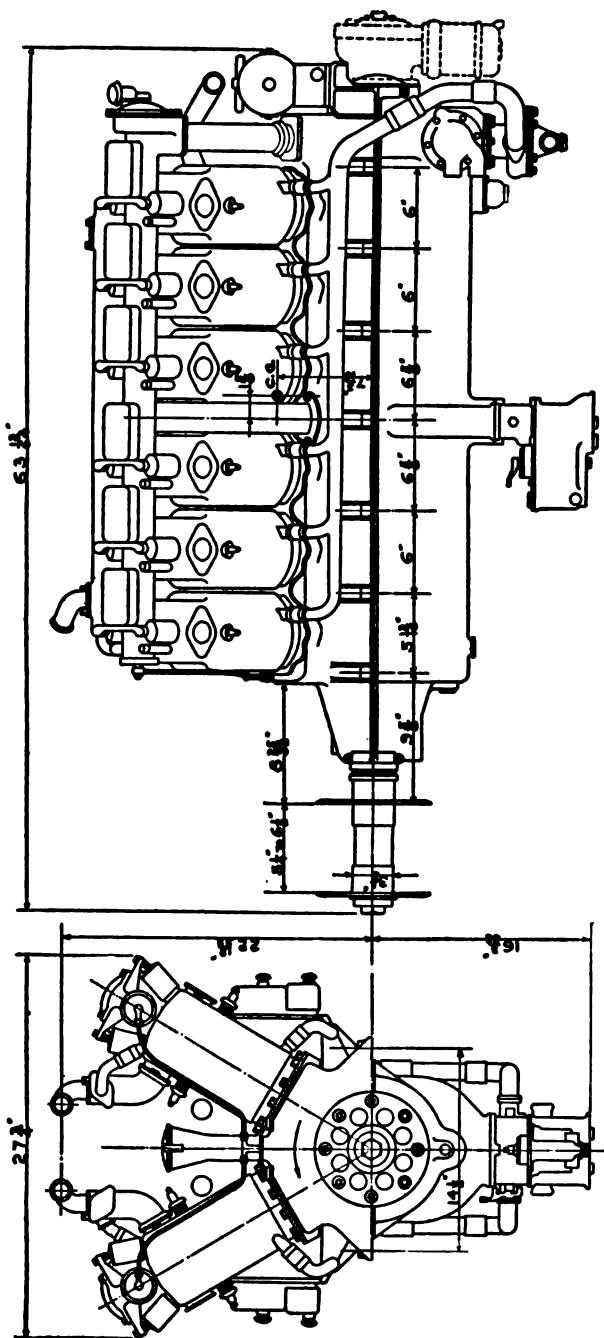
MODEL: C-6 6 CYLINDERS WATER COOLED
160 B.H.P. AT 1750 R.P.M. 420 LBS. DRY 19 LBS. WATER



LAWRANCE AERO ENGINE CORPN. ~ NEW YORK, N.Y.
MODEL: J-1 9 CYLINDERS AIR COOLED
220 B.H.P. AT 1800 R.P.M. 442 LBS. COMPLETE

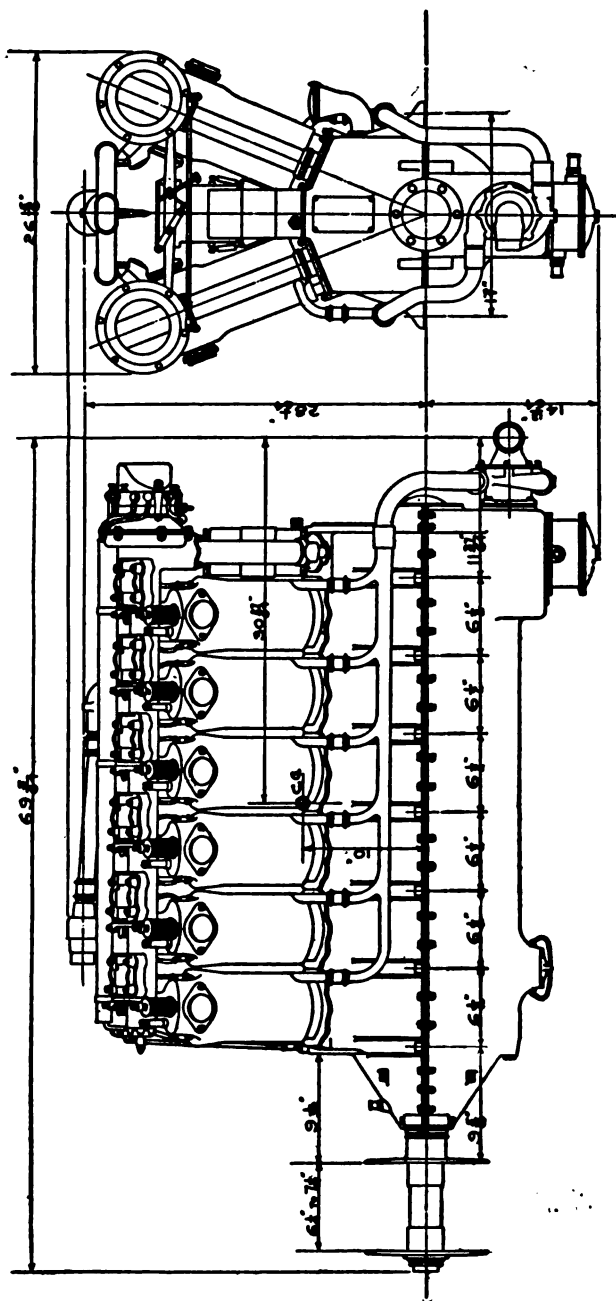


PACKARD MOTOR CAR COMPANY ~ DETROIT, MICH.
MODEL: 1A-825 8 CYLINDERS WATER COOLED
230 B.H.P. AT 1800 R.P.M. 550 LBS. DRY 23 LBS. WATER



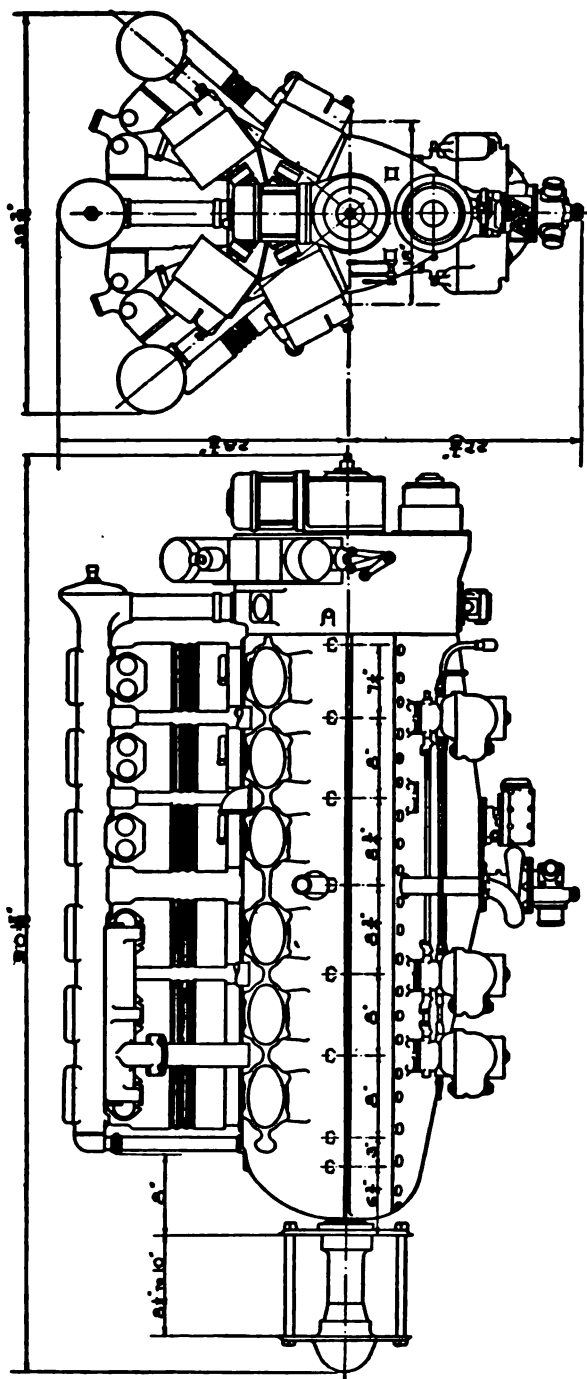
PACKARD MOTOR CAR COMPANY ~ DETROIT, MICH.

MODEL: I-A-1237 12 CYLINDERS WATER COOLED
 350 B.H.P. AT 1800 R.P.M. 740 LBS. DRY 39 LBS. WATER



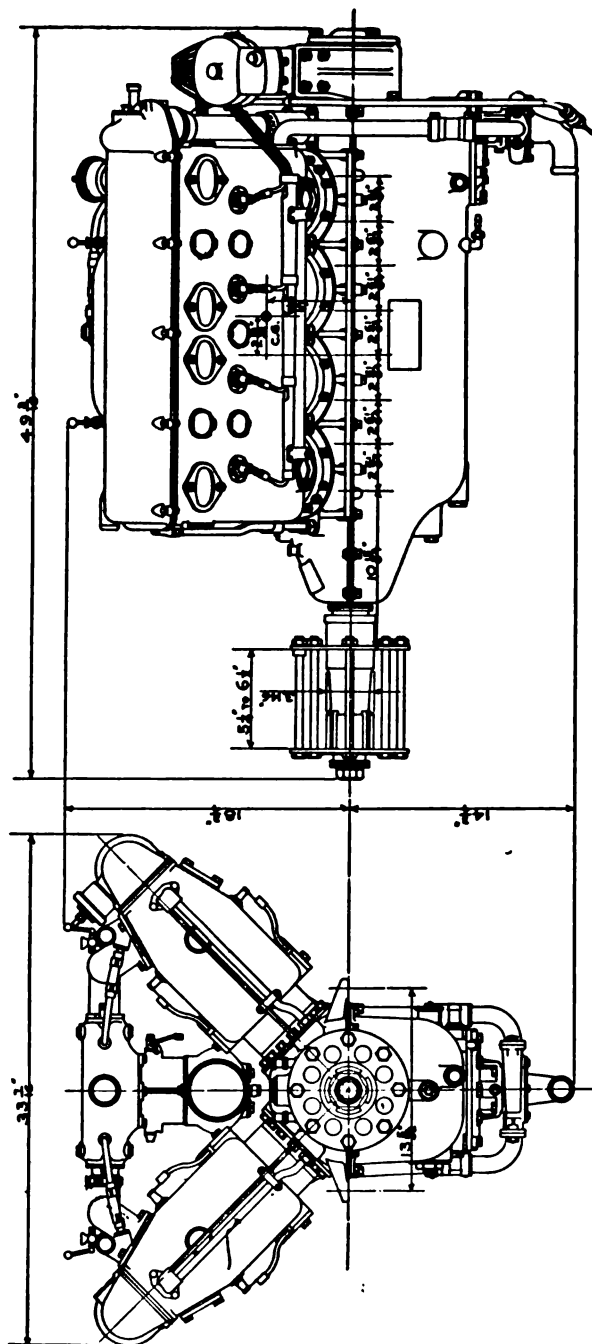
U.S. AIR SERVICE ENGR. DIVISION ~ DAYTON, O.

MODEL: LIBERTY-12-A	12 CYLINDERS	WATER COOLED
420 B.H.P. AT 1700 R.P.M.	844 LBS. DRY	46 LBS. WATER



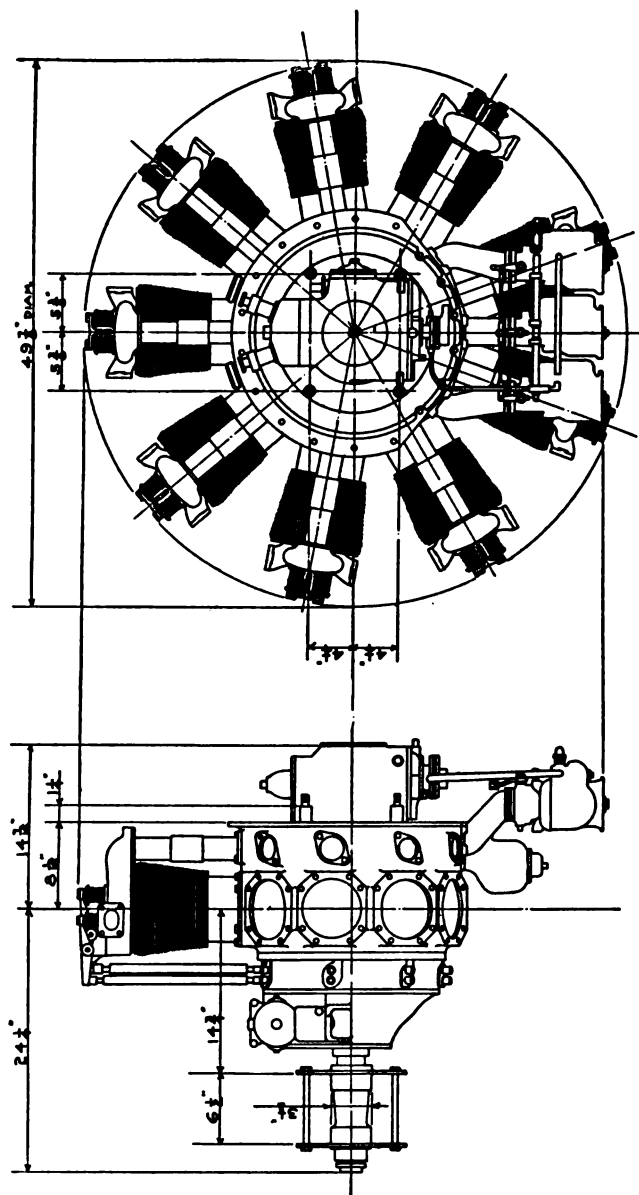
U.S. AIR SERVICE ENGR. DIVISION~DAYTON, O.

**MODEL: W-1 18 CYLINDERS WATER COOLED
700 B.H.P. AT 1700 R.P.M. 1699 LBS. DRY**

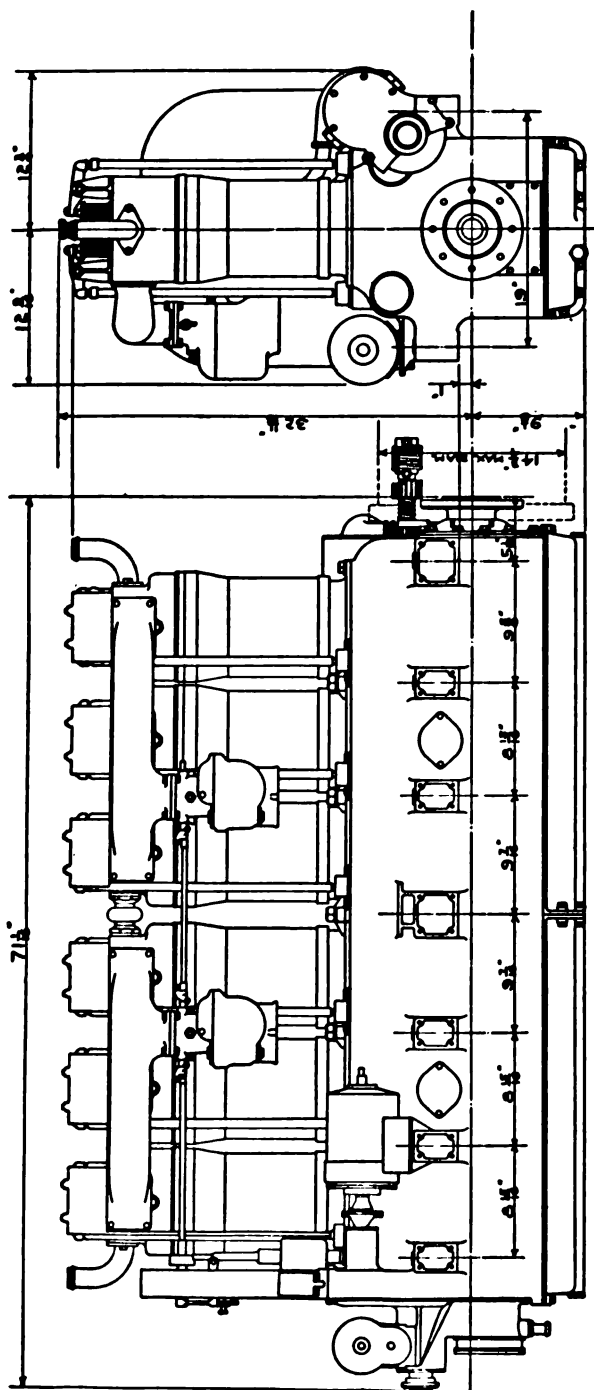


WRIGHT AERONAUTICAL CORPORATION ~ PATERSON, N.J.

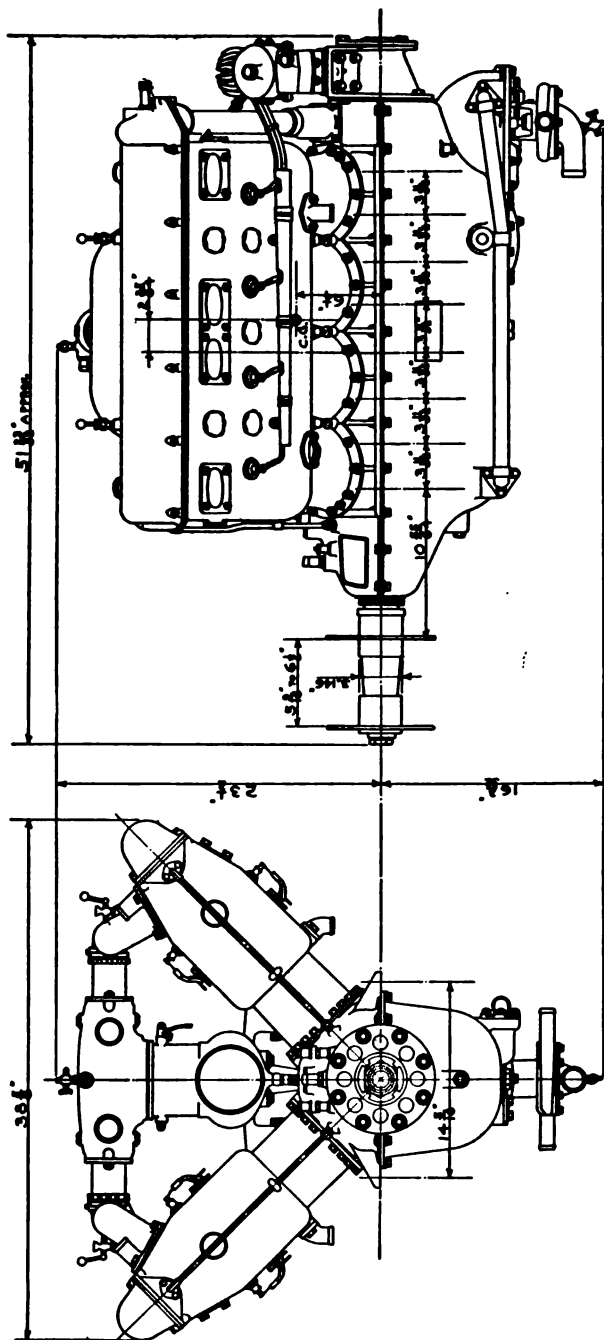
MODEL: E-3	8 CYLINDERS	WATER COOLED
STANDARD: 180 B.H.P. AT 1800 R.P.M.		480 LBS. DRY
ALERTE: 215 B.H.P. AT 2000 R.P.M.		465 LBS. DRY



WRIGHT AERONAUTICAL CORPORATION ~ PATERSON, N.J.
 MODEL: R-1 9 CYLINDERS AIR COOLED
 350 B.H.P. AT 1600 R.P.M. 684 LBS. COMPLETE



WRIGHT AERONAUTICAL CORPORATION ~ PATERSON, N.J.
 MODEL: D-1 6 CYLINDERS WATER COOLED
 400 B.H.P. AT 1400 R.P.M. 1320 LBS DRY



WRIGHT AERONAUTICAL CORPORATION ~ PATERSON, N.J.

MODEL: TYPE 4 8 CYLINDERS WATER COOLED

390 B.H.P. AT 2000 R.P.M. 600 LBS. DRY

APPENDIX

COMMERCIAL SECTION

AERONAUTICAL CHAMBER OF COMMERCE OF AMERICA, INC.

501 Fifth Ave., New York, N. Y.

GOVERNORS

Samuel S. Bradley
B. E. Bushnell
Charles H. Colvin
Sherman M. Fairchild
John M. Larsen

Grover C. Loening
Charles F. Redden
F. B. Rentschler
Frank H. Russell
Lawrence Sperry

C. C. Witmer

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First Vice-President	Charles F. Redden
Second Vice-President	C. C. Witmer
Treasurer	B. E. Bushnell
Secretary and General Manager	S. S. Bradley
Ass't Secretary and Ass't Treasurer.....	Luther K. Bell
Special Representative	Howard L. Mingos

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Pioneers

Orville Wright, Dayton, Ohio.
Glenn H. Curtiss, Garden City, N. Y.

Manufacturing and Engineering

Airship Manufacturing Company of America, Hammondsport, N. Y.
Aeromarine Plane & Motor Company, Keyport, N. J.
A. & D. R. Black, Garden City, N. Y.
Vincent J. Burnelli, Amityville, N. Y.
Cox-Klemin Aircraft Corp., College Point, N. Y.
Curtiss Aeroplane & Motor Corp., Garden City, N. Y.
Dayton Wright Company, Dayton, Ohio.
The Douglas Company, Los Angeles, Cal.
G. Elias & Bro., Inc., Buffalo, N. Y.

Gallaudet Aircraft Corp., East Greenwich, R. I.
Goodyear Tire & Rubber Co., Akron, Ohio.
J. L. Aircraft Corp., New York City.
E. M. Laird Company, Wichita, Kansas.
Lewis & Vought Corp., Long Island City, N. Y.
Lawrance Aero-Engine Corp., New York City.
L. W. F. Engineering Company, College Point, N. Y.
Loening Aeronautical Engineering Corp., New York City.
Longren Aircraft Corp., Topeka, Kansas.
Luftschiffbau-Zeppelin (Harry Vissering), Chicago, Ill.
Manufacturers Aircraft Association, Inc., New York City.
Ordnance Engineering Corp., Baldwin, N. Y.
Packard Motor Car Company, Detroit, Mich.
Lawrence Sperry Aircraft Corp., Farmingdale, N. Y.
Stout Engineering Laboratories, Detroit, Mich.
Thomas-Morse Aircraft Corp., Ithaca, N. Y.
Wright Aeronautical Corp., Paterson, N. J.

Operators and Distributors

Aeromarine Airways, Inc., New York, Key West and Havana.
American Aircraft, Baltimore, Md.
American Investigation Corp., New York City.
C. E. Cheney Aero Co., Greene, Iowa.
S. C. Coon (Curtiss Aircraft Corp.), Dallas, Texas.
Harry Depew Copland, Cambridge 38, Mass.
Curtiss Aeroplane Export Corp., New York, Buenos Aires, Sao Paulo, Lima.
Curtiss Eastern Airplane Co., Philadelphia, Pa.
Curtiss Metropolitan Airplane Co., New York City.
Curtiss Northwest Airplane Co., Minneapolis, Minn.
Diggins Aviation Co., Chicago, Ill.
Easter Airways, Inc., Baltimore, Md.
F. W. Farris, Stockton, Cal.
General Air Service, Washington, D. C.
Huff Daland Aero Corp., Kansas City, Mo.
Johnson Airplane & Supply Co., Dayton, Ohio.
Temple N. Joyce, (Morane-Saulnier), Baltimore, Md.
W. Wallace Kellett (Farman), Philadelphia, Pa.
H. L. Lambert (Lamberton), Ellenboro, W. Va.
Robert W. Lowell, Elyria, Ohio.
R. B. C. Noorduyn (Fokker), New York City.
Robertson Aircraft Corp., St. Louis, Mo.
Foster Russell Aviation Co., Spokane, Wash.
Daisy Smith, Spokane, Wash.
Southwest Airplane Co., Tulsa, Okla.
Marion Sterling, Waco, Texas.
Jack Towberman, Eveleth, Minn.
Triangle Airways, Inc., Chicago, Ill.
Earl T. Vance, Miles City, Mont.
John Perry Wood, Buffalo, N. Y.
Walter T. Varney, San Francisco, Cal.

Accessories and Supplies

American Bronze Corp., Berwyn, Pa.
American Hammered Piston Ring Co., Baltimore, Md.
B. G. Corp., New York City.
Bijur Motor Appliances Co., Hoboken, N. J.
Brewster & Co., Long Island City, N. Y.
Champion Ignition Co., Flint, Mich.
Electric Storage Battery Co., Philadelphia, Pa.
Endicott Forging & Mfg. Co., Endicott, N. Y.
Fairchild Aerial Camera Corp., New York City.
General Aluminum and Brass Mfg. Co., Detroit, Mich.
Hamilton Aero Mfg. Co., Milwaukee, Wis.
Stewart Hartshorn Co., New York City.
Linde Air Products Co., New York City.
Macwhyte Company, Kenosha, Wis.
Meisel Press Mfg. Co., Boston, Mass.
New Jersey Veneer Co., Paterson, N. J.
New York Blue Print Paper Co., New York City.
Park Drop Forge Co., Cleveland, Ohio.
Pennsylvania Hardware and Paint Co., New York City.
Perry-Austen Mfg. Co., Grasmere, Staten Island (P. O. Rosebank), N. Y.
Pioneer Instrument Co., Brooklyn, N. Y.
Radio Corporation of America, New York City.
S. K. F. Industries, New York City.
Simms Magneto Co., East Orange, N. J.
Standard Oil Company (Indiana), Chicago, Ill.
Steel Products Co., Cleveland, Ohio.
Tide Water Oil Sales Corp., New York City.
Valentine & Co., New York City.
Western Brass Mfg. Works, Chicago, Ill.

Publications

Ace (Garey W. Carr), Los Angeles, Cal.
Aerial Age Weekly (G. Douglas Wardrop), New York City.
American Machinist (Fred H. Colvin), New York City.
Army and Navy Journal (H. J. Reilly), New York City.
Aviation and Aircraft Journal (L. D. Gardner), New York City.
Cine-Mundial (A. J. Chalmers), New York City.
Class Journal Company (David Beecroft), New York and Chicago.
U. S. Air Service Magazine (Earl N. Findley), Washington, D. C.

Insurance

National Aircraft Underwriters Association, New York City.

Executives, Engineers, Designers

E. R. Armstrong (Dupont Engineering), Wilmington, Del.
F. E. Baldwin, Wright Aeronautical Corp.
Luther K. Bell, New York City.
L. W. Bettiger, L. W. F. Engineering Co.
R. R. Blythe (Johnson & Higgins), New York City.

J. J. Boland, Aeromarine Plane & Motor Co.
S. S. Bradley, New York City.
George W. Browne, Curtiss Aeroplane & Motor Corp.
H. A. Bruno, Aeromarine Plane & Motor Co.
John R. Cautley, Wright Aeronautical Corp.
Albert Champion, Champion Ignition Co.
Roland Chilton, Aeromarine Plane & Motor Co.
Virginus E. Clark, Dayton Wright Co.
Henry M. Crane, New York City.
Donald Douglas, The Douglas Co.
Sherman M. Fairchild, Fairchild Aerial Camera Corp.
A. J. Flachbar, L. W. F. Engineering Co.
Albert H. Flint, L. W. F. Engineering Co.
Edson F. Gallaudet, Gallaudet Aircraft Corp.
W. L. Gilmore, Curtiss Engineering Corp.
Clarence D. Hanscom, East Orange, N. J.
Fred S. Hardesty, General Air Service.
J. L. Harkness, L. W. F. Engineering Co.
Beckwith Havens, Airship Mfg. Co. of America.
William Henry, The Douglas Co.
George H. Houston, New York City.
G. Sumner Ireland, Curtiss Eastern Airplane Co.
C. F. Kettering, General Motors Corp.
C. Roy Keys, Curtiss Aeroplane & Motor Corp.
William Klein, San Francisco, Cal.
Alexander Klemin, Cox-Klemin Aircraft Corp.
Herman T. Kraft, Goodyear Tire & Rubber Co.
Chas. L. Lawrance, Lawrance Aero-Engine Corp.
Wm. B. Leberherz, Gallaudet Aircraft Corp.
Albert P. Loening, Loening Aeronautical Engineering Corp.
Grover C. Loening, Loening Aeronautical Engineering Corp.
Hugh D. McKay, American Airways, College Point, N. Y.
Charles M. Manly, New York City.
Hamilton Maxwell, Aerial Photography, New York City.
George Mead, Wright Aeronautical Corp.
F. L. Morse, Thomas-Morse Aircraft Corp.
Ladislav d'Orcy, New York City.
C. G. Peterson, Wright Aeronautical Corp.
Stephen H. Philbin, New York City.
H. L. Pope, Wright Aeronautical Corp.
Otto Praeger, New York City.
J. F. Prince, Wright Aeronautical Corp.
C. F. Redden, Aeromarine Airways, Inc.
F. B. Rentschler, Wright Aeronautical Corp.
Herman B. Ring, Lawrance Aero-Engine Corp.
J. K. Robinson, Jr., Gallaudet Aircraft Corp.
John M. Rogers, Wright Aeronautical Corp.
Frank H. Russell, Curtiss Aeroplane and Motor Corp.
Edward Schildhauer, General Air Service.
R. W. Schroeder, Underwriters' Laboratories, Inc., Chicago, Ill.
L. R. Seidell, New York Testing Laboratories, New York City.
A. R. Small, Underwriters' Laboratories, Inc., Chicago, Ill.

Lawrence Sperry, Lawrence Sperry Aircraft Corp.
Wm. B. Stout, Stout Engineering Laboratories.
Joseph B. Strauss, Chicago, Ill.
H. E. Talbott, Dayton Wright Company.
J. P. Tarbox, Curtiss Engineering Corp.
Robert G. Thach, New York City.
Milton Tibbetts, Packard Motor Car Co.
I. M. Uppercu, Aeromarine Plane & Motor Company.
Ralph H. Upson, New York City.
Adrian Van Muffling, New York City.
J. G. Vincent, Packard Motor Car Co.
Harry Vissering (Luftschiffbau-Zeppelin), Chicago, Ill.
Chance M. Vought, Lewis & Vought Corp.
Prof. E. P. Warner, Massachusetts Institute of Technology, Cambridge, Mass.
George S. Wheat, Wright Aeronautical Corp.
C. L. Williams, Williams Bros. Aircraft Corp., San Francisco, Cal.
G. M. Williams, Dayton Wright Co.
C. C. Witmer, Airship Mfg. Co. of America.
W. W. Wyman, C. L. Maguire Petroleum Co., Chicago, Ill.
W. C. Young, Goodyear Tire & Rubber Co.
Paul Zimmermann, Aeromarine Plane & Motor Co.

OBJECTS OF THE AERONAUTICAL CHAMBER OF COMMERCE
OF AMERICA, AS SET FORTH IN THE ARTICLES
OF INCORPORATION

To foster, advance, promulgate, and promote trade and commerce, throughout the United States, its territories, possessions, and in foreign countries, in the interests of those persons, firms or corporations engaged in the business of manufacturing, buying, selling and dealing in aircraft, aircraft motors, and aircraft parts and accessories of every kind and nature.

To reform any and all abuses which may arise relative thereto.

To secure for its members and those persons, firms or corporations dealing with them, freedom from unjust or unlawful exactions of whatever description.

To diffuse among its members accurate and reliable information as to the standing of its members and those persons, firms or corporations engaged in similar lines of business.

To procure uniformity and certainty in the customs and usages of trade and commerce among its members and those persons, firms or corporations having a common trade, business or professional interest in all matters pertaining to aeronautics.

To aid and assist in mapping out air roads and lanes; the location of landing fields, airdromes, hangars, or such other structures as may be necessary for the advancement of aeronautics.

To advocate and promote in every lawful way the enactment of just and equitable laws, both national and state, pertaining to aeronautics.

To settle, adjust and arbitrate any and all differences which may arise between its members, and persons, firms or corporations dealing with them.

To promote a more enlarged and friendly intercourse between its members and persons, firms and corporations engaged in the business of, or dealing in aircraft, aircraft motors and aircraft parts and accessories.

To acquire by grant, gift, purchase, devise, bequest, and to hold and dispose of, such property or assets as the purposes of the corporation shall require, subject to such restrictions as may be prescribed by law, and

Generally to do every act and thing which may be necessary and proper for the advancement of the aeronautical art and industry and the accomplishment of the objects and purposes hereinbefore set forth; provided, however, that nothing herein contained shall authorize this corporation to engage in any business for pecuniary profit.

MANUFACTURERS AIRCRAFT ASSOCIATION, INC.

501 Fifth Ave., New York, N. Y.

MEMBERSHIP

Aeromarine Plane & Motor Co., Keyport, N. J.
 Boeing Airplane Company, Seattle, Wash.
 Burgess Company, Marblehead, Mass.
 Curtiss Aeroplane & Motor Corp., Garden City, L. I., N. Y.
 Curtiss Engineering Corp., Garden City, L. I., N. Y.
 Dayton Wright Company, Dayton, Ohio.
 Fisher Body Corp., Detroit, Mich.
 Gallaudet Aircraft Corp., East Greenwich, R. I.
 L. W. F. Engineering Co., College Point, L. I., N. Y.
 Lewis & Vought Corporation, Long Island City, N. Y.
 Glenn L. Martin Company, Cleveland, Ohio.
 Packard Motor Car Company, Detroit, Mich.
 Sturtevant Aeroplane Co., Farmingham, Mass.
 Thomas-Morse Aircraft Corp., Ithaca, N. Y.
 West Virginia Aircraft Co., Wheeling, W. Va.
 Wright Aeronautical Corp., Paterson, N. J.

TRUSTEES

Dr. Joseph S. Ames, National Advisory Committee for Aeronautics and member of faculty, Johns Hopkins University.
 George H. Houston, New York.
 Albert H. Flint, New York.

DIRECTORS

J. K. Robinson, Jr.	I. M. Uppercu
F. B. Rentschler	A. H. Flint
F. H. Russell	F. L. Morse
G. M. Williams	Glenn L. Martin
Col. J. G. Vincent	

OFFICERS

President J. K. Robinson, Jr.
 Vice-President G. M. Williams
 Secretary F. H. Russell
 Treasurer F. B. Rentschler
 General Manager and Ass't Treasurer S. S. Bradley



Marshal Foch at American Legion Flying Meet, Kansas City, Oct. 31-Nov. 1, 2. *Below*—An episode in the air mail—Landing on a mountain in the Rockies.



Loening "*Flying Yacht*" taking off. Below—Aerial view of Muscle Shoals, Ala., power project.—Photo, Wide World.

U. S. AIR SERVICE, WAR DEPARTMENT

Munitions Building, Washington, D. C.

ORGANIZATION

Under the reorganization of the Office of the Chief of Air Service, approved by General Patrick on Dec. 1, 1921, five divisions in the Army Air Service are provided: Personnel; Information; Training and War Plans; Supply, and Engineering. The Office of the Chief includes the Assistant Chief of Air Service and the Executive Office. Subordinate to the Executive Office are the Finance and Medical Sections, the Legal Advisor and the Director of Aircraft Production (Spruce Production Corporation). The orders and files section is under the immediate supervision of the Chief Clerk. The Personnel Division is composed of three sections—Officers, Enlisted and Civilian. The Information Division comprises the Library Section, Special Section and Reproduction Section. Five sections comprise the Training and War Plans Division: Schools; Tactical Units; Reserve Officers Training Corps; National Guard, and Officers Reserve; War Plans Section and Airways Section. The Supply Division embraces Property Requirements; Procurement; and Material, Disposal and Salvage. The Engineering Division, located at McCook Field, Dayton, Ohio, a technical representative of which is on duty in Washington, is composed of the Planning, Technical, Factory, Flying, Procurement, Supply, Patents and Military Sections.

OFFICERS ON DUTY IN WASHINGTON

Office of the Chief

Maj. Gen. Mason M. Patrick.....Chief, Air Service.
*Brig. Gen. William E. Mitchell.....Asst. Chief, Air Service.
*Maj. Walter H. Frank.....Executive.
*Maj. Herbert R. Harmon.....Asst. Executive.
Maj. (JAG) Elza C. Johnson.....Legal Advisor.

Personnel Division

Maj. Rush B. Lincoln.
*Maj. John W. Simons, Jr.

Information Division

*Maj. Horace M. Hickam.
*Capt. David S. Seaton.
Capt. Edgar P. Sorenson.

* Pilot.

Finance Section and Budget Officer

*Maj. Genner Y. Chisum.
Capt. William F. Volandt.

Medical Section

Col. (MC) Albert E. Truby.
Maj. (MC) Benjamin B. Warner.
Capt. (MC) Wm. J. Freebourn.

and Arizona; headquarters, Ft. Sam Houston, San Antonio, Texas. Air Service Officer, *Maj. Frank D. Lackland.

Ninth Corps Area—Includes Washington, Oregon, Idaho, Montana, Wyoming, Utah, Nevada and California; headquarters Presidio, San Francisco, Cal. Air Service Officer, *Maj. Henry H. Arnold.

Hawaiian Department—Includes Hawaiian Islands and dependencies; headquarters, Honolulu, Hawaii. Air Service Officer, *Maj. John F. Curry.

Philippine Department—Includes all of Philippine archipelago and troops in China; headquarters, Manila, Philippine Islands. Air Service Officer, *Maj. Byron Q. Jones.

Panama Canal Department—Includes entire Canal Zone; headquarters, Quarry Heights, Balboa Heights, Canal Zone. Air Service Officer, *Maj. Raycroft Walsh.

STATIONS AND ACTIVITIES UNDER JURISDICTION OF CHIEF OF AIR SERVICE

<i>Name</i>	<i>P. O. Address</i>	<i>Activity</i>
Akron, O.	c/o Goodyear Tire & Rubber Co.	District Office. Balloon Production and Inspection Procurement Division.
Americus Air Intermediate Depot (Souther Field)	Americus, Ga.	Supply Depot.
Buffalo, N. Y.	2050 Elmwood Ave.	District Office, Material Disposal & Salvage Div.
Curtiss Elmwood Air Reserve Depot	2050 Elmwood Ave., Buffalo, N. Y.	Reserve Depot.
Carlstrom Field	Arcadia, Fla.	Pilots School.
Chanute Field	Rantoul, Ill.	A. S. Mechanics School.
Fairfield Air Intermediate Depot (& Wilbur Wright Field)	Fairfield, O.	Supply Depot. Stockkeepers School.
†Langley Field	Hampton, Va.	Field Officers' School U. S. Army School Aerial Photography Airship School.
Little Rock Air Intermediate Depot	Little Rock, Ark.	Supply Depot.
Long Island Air Reserve Depot	U. S. Aeronautical Engine Plant, L.I.C.	Aer. Engine Plant, District Office, Procurement Division.
McCook Field	Dayton, O.	Engineering Div., A. S. Engineering School.
Middletown Air Intermediate Depot	Middletown, Pa.	Supply Depot.
Montgomery Air Intermediate Depot	Montgomery, Ala.	Repair Depot.
New York, N. Y.	Starr & Borden Aves., Long Island City, L. I.	District Office Procurement Div.

* Pilot.

† See activities under jurisdiction of Corps Area or Department Commanders.

<i>Name</i>	<i>P. O. Address</i>	<i>Activity</i>
Portland, Oregon Post Field (See Ft. Sill)	Couch Building	U. S. Spruce Production Corp.
Richmond Air Intermediate Depot	Richmond, Va.	Supply Depot.
Rockwell Air Intermediate Depot	Rockwell Field	Supply and Repair Depot.
	Coronado, Cal.	Border Patrol & Base Border Operations of War Dept. †Flying Field.
Ross Field	Arcadia, Cal.	Balloon School.
San Antonio Air Intermediate Depot	San Antonio, Tex.	Supply Depot. Aviation Repair Depot.

STATIONS AND ACTIVITIES UNDER JURISDICTION OF CORPS AREA OR DEPARTMENT COMMANDERS

Bliss, Ft., Tex.	El Paso, Tex.	Border Patrol.
*Bolling Field	Anacostia, D. C.	†Flying Field.
Brooks Field	San Antonio, Tex.	Airship Training.
Chapman Field	Miami, Fla.	Temp. Stor. Depot.
Clark Field	Camp Stotsenburg, Pampanga, P. I.	Aerial Coast Defense.
Crissy Field	Presidio of San Francisco, Cal.	
Dorr Field	Arcadia, Fla.	Temp. Stor. Depot.
Ellington Field	Houston, Tex.	Flying Field.
France Field	Panama, C. Z.	Aerial Coast Defense.
Houston, Tex.	Camp Logan, Tex.	Temp. Stor. Depot.
Kamehameha, Ft.	Honolulu, Hawaii	Balloon Field.
Kelly Field	Kelly Field, Tex.	Hdqs. 1st Wing Flying Field, Base Border Operations of 8th Corps Area.
Kindley Field	Ft. Mills, Corregidor Island, P. I.	Aerial Coast Defense.
‡Langley Field	Hampton, Va.	Hdqs. Aerial Coast Defense Flying Field.
Lee Hall, Va.	Lee Hall, Va.	Aerial Coast Defense.
§Love Field	Hawes, Tex.	Temp. Stor. Depot.
Luke Field	Ford's Island, Pearl Harbor, Oahu, H. T.	Aerial Coast Defense.
March Field	Riverside, Cal.	
Mather Field	Mills, Cal.	Flying Field.
Mitchel Field	Garden City, L. I., N. Y.	Hdqs. for A. S. Activities on Long Island, Medical Research Laboratory, Flight Surgeon's School.

* Correspondence through C. G., Dist. of Washington.

† Denotes stations that are inactive. By "Inactive Stations" is meant those stations at which the function indicated is not in active operation.

‡ See activities under jurisdiction of the Chief of Air Service.

§ Under process of abandonment.

<i>Name</i>	<i>P. O. Address</i>	<i>Activity</i>
Morrison, Va.	Morrison, Va.	Temp. Stor. Depot.
*Omaha, Fort	Omaha, Nebr. ....	.
Park Field	Millington, Tenn.	Temp. Stor. Depot.
Philippines	Manila, P. I.	Aerial Coast Defense.
*Rich Field	Waco, Tex.	Temp. Stor. Depot.
Riley, Fort	Ft. Riley, Kans.	Cavalry School.
Ross Field	Arcadia, Cal.	Balloon School.
Ruger, Fort	Honolulu, Hawaii	Balloon School.
Selfridge Field	Mt. Clemens, Mich.	Temp. Stor. Depot.
Scott Field	Belleville, Ill.	Temp. Stor. Depot.
		Airship Operating Sta- tion.

ACTIVITIES UNDER JURISDICTION OF POST COMMANDER AT WHICH ACTIVITIES ARE STATIONED

Aberdeen Proving Ground..	Aberdeen Proving Ground, Md.	Ordnance Proving Ground.
Godman Field	Camp Knox, Ky.	Artillery Firing Center.
Langin Field	Moundsville, W. Va.	Intermediate Ldg. Field.
Pope Field	Fayetteville, N. C.	Artillery Firing Center.
Sill, Ft.	Ft. Sill, Okla.	A. S. Observation School. A. S. Communication School. Cavalry School.

* Under process of abandonment.

BUREAU OF AERONAUTICS, NAVY DEPARTMENT

ORGANIZATION

The Bureau of Aeronautics of the Navy Department was established Aug. 10, 1921, in accordance with Section 8 of the Act Making Appropriations for the Naval Service for the fiscal year ending June 30, 1922 (Public No. 35 67th Congress) and General Order No. 65 of the Navy Department. The Bureau is divided into four divisions as follows: Plans—Administration—Material—Flight. The Planning Division, as its name indicates, deals with the planning of the work of the Bureau, the formulation of plans for war in conjunction with the Planning Sections of the Office of Naval operations, recommendations concerning types of aircraft which are necessary for Naval Aviation, etc. The Administration Division handles all civilian personnel employed under the jurisdiction of the Bureau of Aeronautics, works up the budget which will be required for the operation of all matters under the jurisdiction of the Bureau and keeps a record of and approves of the expenditures of funds allotted to the Bureau. The Material Division has under its jurisdiction all matters pertaining to the design of aircraft and matters pertaining thereto. The Flight Division has under its cognizance all matters pertaining to the operation of naval aircraft, training of personnel, aviation photographs and aerology. Coordination with the Navy department is attained through the Council, the Chief of the Bureau acting as a member of the council. The relation to the General Board is the same as other Bureaus of the department. The Naval Bureau coordinates with the Army Air service through the Aeronautical Board composed equally of members from the Army and the Navy. A representative of the Bureau also serves on the National Advisory Committee for Aeronautics, the Board of Surveys and Maps, Board of Airplane Design Competition, American Engineering Standards Committee, Safety Code on Aeronautics by means of which it is coordinated with other aeronautical activities.

OFFICERS ON DUTY IN WASHINGTON

Office of the Chief

Rear Admiral W. A. Moffett Chief, Bureau of Aeronautics.
*Capt. H. C. Mustin Asst. Chief, Bureau of Aeronautics.
Commdr. W. J. Giles Aide to Chief, Bureau of Aeronautics.

Administrative Division

Commdr. V. K. Coman.
Lt. Commdr. R. M. Griffin.
*Lt. Commdr. S. H. Quarles.

Material Division

Commdr. E. S. Land (CC).
Commdr. J. C. Hunsaker (CC).
Lt. Commdr. S. M. Kraus.
Lt. Commdr. G. Fulton (CC)
*Lt. Commdr. B. G. Leighton
Lt. Commdr. G. B. Wilson.

* Pilot.

BUREAU OF AERONAUTICS, NAVY DEPARTMENT 173

Plans Division

*Commdr. T. G. Ellyson.
*Lt. Commdr. Z. Lansdowne.
*Lt. Commdr. W. Capehart.

Flight Division

*Lt. Commdr. E. W. Spencer.
*Lt. R. G. Pennoyer.
*Lt. W. L. Richardson.

OFFICERS WITH THE FLEETS

(Atlantic Fleet)

Capt. A. W. JohnsonCommander Air Squadrons.
Lt. Commdr. H. T. BartlettCommander Torpedo Plane Squadron.
Commdr. A. C. ReadAide to Commander Air Squadrons.
Lt. Commdr. H. B. CecilAviation Aide to Commander-in-Chief.

(Pacific Fleet)

Capt. H. V. ButlerCommander Air Squadrons.
Lt. Commdr. P. N. L. Bellinger.....Aide to Commander Air Squadrons.
Lt. Commdr. M. A. Mitscher.....Commander Spotting Squadron No. 4.
Lt. Commdr. G. D. MurrayCommander Spotting Squadron No. 3.
Lt. Commdr. W. MasekCommander Combat Squadron No. 4.

NAVAL AIR STATIONS

Place

Officer in Command

Lakehurst, N. J.Lt. Commdr. J. P. Norfleet.
Hampton Roads, Va.Capt. S. H. R. Doyle.
Pensacola, Fla.Capt. H. H. Christy.
Anacostia, D. C.Lt. R. H. Bush.
Coco Solo, C. Z.Lt. Commdr. V. D. Herbster
San Diego, Cal.Commdr. F. R. McCrary.
Pearl Harbor, T. H.Lt. Commdr. R. D. Kirkpatrick.
Philadelphia, Pa.Commdr. G. C. Westervelt.

Experimental work in aircraft radio is carried on at Anacostia. Training in seaplanes is done at Pensacola, and some training in land planes at San Diego. Test flights of newly built planes of recent design are made at the Naval Aircraft Factory, Philadelphia.

• Pilot.

MARINE CORPS, NAVY DEPARTMENT

Organization

Marine aviation is an integral part of the Marine Corps, and its mission is to furnish the air forces necessary to Marine expeditionary duty, Marine advanced base operations, and the defense of Naval bases outside the continental United States which are defended on shore by Marines. In peace time, in addition to training and preparation for these duties, the Marine Corps aviation carries on air operations similar to those of the Army Air Service. Its officers are detailed to aviation duty from permanent line officers of the Corps and its enlisted men are Marines enlisted especially for aviation duty. The administration, training and operations of Marine aviation are directed by the Chief of Aviation, Headquarters U. S. Marine Corps, whose office constitutes a section of the division of Operations and Training of the Major General Commandant's Office. All matters pertaining to finance and supply of Marine aviation are under the cognizance of the Bureau of Aeronautics, to which bureau are made all appropriations for the maintenance and operations of Marine Corps aviation. The Bureau of Aeronautics upon recommendations from the Marine Corps and within the limits of the latter's allotment of funds, handles the maintenance and supply of all Marine Corps aviation stations; provides necessary aircraft and accessories and contracts for new types of same, and furnishes technical advice and recommendations to the Marine Corps. The other bureaus of the Navy Department supply Marine aviation with equipment such as radio apparatus, navigation instruments, and ordnance which are under their cognizance, and for which an allotment of funds is made by the Bureau of Aeronautics. Direct and active liaison is maintained between Marine aviation and the Army Air Service, the Postal Air Service and the National Advisory Committee for Aeronautics.

OFFICERS

- | | |
|------------------------------|----------------------------|
| *Lt. Col. T. C. Turner. | *Capt. Benjamin Goodman. |
| *Maj. Alfred A. Cunningham. | *Capt. George W. Martin. |
| *Maj. Francis T. Evans. | *Capt. Ralph J. Mitchell. |
| *Maj. Roy S. Geiger. | *Capt. Francis P. Mulcahy. |
| *Capt. Robert J. Archibald. | *Capt. Arthur H. Page, Jr. |
| *Capt. David L. S. Brewster. | *Capt. Russell A. Presley. |
| *Capt. James E. Davis. | *Capt. Harry H. Shepherd. |

AVIATION STATIONS

Marine Flying Field, Marine Barracks, Quantico, Va.
Marine Flying Field, Marine Barracks, Parris Island, S. C.
First Air Squadron, U. S. Marine Corps, Santo Domingo City, D. R.
Fourth Air Squadron, U. S. Marine Corps, Port Au Prince, Haiti.
Flight "L," U. S. Marine Corps, Sumay, Guam, M. I.

• Pilot.

STRENGTH OF U. S. AIR FORCES (ARMY, NAVY, MARINE)

	<i>Officers</i>	<i>Aviators</i>	<i>Students</i>	<i>Enlisted Men</i>	<i>Totals</i>
Army (Sept. 1921)	*996		164	7,160	8,320
Navy (Jan. 1922)	171	366	6	5,001	5,544
Marine (Jan. 1922)	30	46		740	816
	<hr/> 1,197	<hr/> 412	<hr/> 170	<hr/> 12,901	<hr/> 14,680

* Of the 996 army flying officers, 792 are flying and 204 are non-flying officers. Of the flying officers, 5 are military aviators, 663 airplane pilots, 17 airship pilots, 25 airplane observers, 82 balloon observers. One hundred and fifty-four of the non-flying officers are undergoing instruction.

DIPLOMATIC SERVICE OF THE UNITED STATES

France.....*Maj. Lewis H. Brereton, Army Air Service, Attaché, Paris.
 *1st Lt. Max Balfour, Army Air Service, Asst. Air Attaché.
 Germany.....*Maj. Benjamin D. Foulois, Army Air Service, Berlin.
 *Maj. Harold Geiger, Army Air Service, Berlin.
 Lt. F. P. Gulbert, Naval Attaché, Berlin.
 Great Britain..*Maj. Charles C. Benedict, Army Air Service, London.
 Lt. Commdr. Newton H. White, Naval Attaché, London.
 Italy.....*Maj. James E. Chaney, Army Air Service, Rome.
 Japan.....*Maj. Arthur R. Christie, Army Air Service, Tokyo.

DIPLOMATIC SERVICE TO THE UNITED STATES

France.....*Capt. Guy D. deLavergne, Air Attaché, Washington, D. C.
 Great Britain..*Wing Commander M. G. Christie.
 Italy.....*Lt. Col. Alessandro Guidoni, Air Attaché, Washington, D. C.
 Peru.....Capt. Juan Leguia y Swayne, Naval Air Attaché, Wash., D. C.

* Pilot.

AERONAUTICAL BOARD

Munitions Building, Washington, D. C.

(For function see "Year Book," 1921.)

ARMY

**Maj. Gen. Mason M. Patrick, U. S.
A., Chairman.
Lt. Col. J. E. Fechet, A. S.
Lt. Col. A. W. Fuller, A. S.**

NAVY

**Rear Admiral W. A. Moffett, U. S. N.
Commdr. J. C. Hunsaker, U. S. N.
Commdr. W. S. Pye, U. S. N.**

WORKING COMMITTEE

Maj. M. F. Harmon, Jr.

Vice Lt. George C. Tinsley.

TECHNICAL COMMITTEE

OPERATIONS, HEAVIER-THAN-AIR

Capt. H. E. Hartney.

Commdr. Kenneth Whiting.

OPERATIONS, LIGHTER-THAN-AIR

Maj. Oscar Westover.

DESIGN AND CONSTRUCTION, HEAVIER-THAN-AIR

Maj. Henry W. Harms.

Comm. H. C. Richardson.

DESIGN AND CONSTRUCTION, LIGHTER-THAN-AIR

Maj. G. E. A. Hallett.

Lt. Commdr. G. Fulton.

AERONAUTICAL POWER PLANTS

Maj. H. S. Martin.

Lt. Commdr. S. M. Kraus.

SECRETARY

Capt. D. S. Seaton.

HELIUM BOARD

ARMY-NAVY HELIUM BOARD PERSONNEL

Lt. Commdr. S. M. Kraus, U. S. N., Lt. Commdr. B. G. Leighton, U. S. N.
Chairman.

Maj. P. E. Van Nostrand, A. S. Lt. R. S. Olmstead, A. S.

The U. S. Helium Production Plant began operating March 28, 1921, and continued until Nov. 30, when it was placed on an inoperative basis. The plant up to Nov. 8, 1921, produced about 2,000,000 cubic feet of helium. It is estimated that there was in storage at the time the plant closed, approximately 2,400,000 cubic feet of helium. A non-rigid airship, U. S. Navy C-7, has been erected and inflated with helium and flown with very marked success, the losses of gas due to valving, blowing and diffusion having been practically nil.

BOARD OF SURVEYS AND MAPS

(Department of Interior)

COMMITTEE ON PHOTOGRAPHIC SURVEYING

T. P. Pendleton, Geological Survey, Lt. G. W. Goddard, A. S.
Chairman. Lt. Commdr. Wadleigh Capehart,
G. C. Mattison, Coast & Geodetic U. S. N.
Survey.

Maj. James W. Bagley, Corps of Engineers.

The Board of Surveys and Maps is interested in aviation only as its work may be applied to map-making by means of aerial photography. Study of the subject and contact with the activities of the various Government map-making agencies interested in aerial surveying is accomplished through a Committee on Photographic Surveying which acts as an advisory body to the federal agencies engaged in photographic surveys.

AIRCRAFT APPROPRIATIONS, FOREIGN

Country	1920		1921		1922	
	Total Appropriations	Civil Aviation	Total Appropriations	Civil Aviation	Total Appropriations	Civil Aviation
Argentina	\$2,000,000	.....	.....	.....
Australia	£100,000	.....	£100,000	.....	.....
Belgium	9,945,000 francs	22,000,000 francs	.....	.....	.....
Canada	\$2,000,000	\$850,000	\$1,625,000	\$700,000	.....	.....
Chile	† \$500,000	.....	.....	.....
China	\$2,000,000	.....	.....	.....
Czecho-Slovakia	6,800,000 kr.	.....	9,680,000 kr.	.....
Cuba	\$10,970.76	.....	.....	.....
Ecuador	20,000 sucres	.....	.....	.....
France	128,794,770 francs	.....	147,374,012 francs	436,000,000 francs	147,219,970 francs
Great Britain	£21,471,495	£894,540	£19,033,400	£880,000	£13,317,100	£4,944,000
Italy	55,500,000 lire	27,000,000 lire	64,700,000 lire	22,060,000 lire	.....	.....
Japan	43,000,000 yen	.....	.....	.....
Mexico	6,000,000 (6 mo) pesos	.....	.....	.....
Netherlands	* 1,315,000 fl.	.....
Peru	† \$500,000	.....	.....	.....
Portuguese East Africa	100,000 escudos	.....	.....	.....
Roumania	35,000,000 leis	9,000,000 leis	.....	.....
Serbia	12,000,000 dinars	.....	.....	.....
Sweden	170,000 kroner	36,000 kroner	.....
Uruguay	\$260,270	\$5,170	.....	.....

AIRCRAFT APPROPRIATIONS, U. S.

Year	Army	Navy	Post Office	National Ad- visory Com. for Aeronautics
1899	* \$ 50,000	.....	.....	.....
1909	† 30,000	.....	.....	.....
1912	‡ 125,000	\$ 25,000	.....	.....
1913	‡ 100,000	10,000	.....	.....
1914	‡ 175,000	10,000	.....	.....
1915	‡ 200,000	10,000	.....	\$ 5,000.00
1916	‡ 800,000	1,000,000	.....	5,000.00
1917	‡ 18,081,666	3,500,000 ^c	.....	87,515.70
1918	‡ 734,750,000 ^a	61,133,000 ^d	\$ 100,000	112,000.00
1919	952,304,758 ^b	220,383,119 ^e	100,000	205,000.00
1920	25,000,000	25,000,000	850,000	175,000.00
1921	33,000,000	20,000,000	1,250,000	200,000.00
§1922	19,200,000	13,413,431	1,250,000	200,000.00

‡ Aviation activities under the Signal Corps of U. S. Army.

‡ Money allotted to Dr. S. P. Langley for his experiments in aerodynamics.

† To pay for Wright airplane which completed tests July 30, 1909.

^a Revocations of \$2,000,000 made on this item.

^b Revocations of \$485,000,000 made on this item.

^c Expenditures in excess of this amount charged to appropriations for 1918.

^d \$32,576,078.13 being an unexpended balance was reappropriated by act of July 1, 1918, and made available for expenditure during fiscal year 1918.

^e \$97,000,000 of this item returned to Treasury.

§ See detailed table below.

DETAILED APPROPRIATIONS, 1921-1922

	1921-1922		1922-23	
	Asked	Appropriated	Asked	Appropriated
Air Mail	\$ 3,500,000	\$ 1,250,000	\$ 2,200,000	
Army Air Service ...	60,000,000	19,200,000	15,210,770	
* Bureau of Plant Industry .....	.....	700-800	.....
* Forest Service .....	.....	50,000	.....
* Geological Survey ..	.....	2,400	.....
Helium Board .....	.....	500,000	†800,000	
Natl. Adv. Com. for Aero. ....	.....	200,000	250,000	
Naval Aviation	35,000,000	13,413,431	17,043,310	
* Weather Bureau ...	.....	81,000	.....

* Represents the sum allotted by the Department for experimental purposes. No specific sum was provided for these services in the regular appropriation bills.

† Sum included in total appropriations for army and navy.

AIRCRAFT PRODUCTION COST, 1917-1918

[Reprinted from April 18-25, 1921, issues *Aviation and Aircraft Journal*]

COST OF WAR AVIATION ONLY \$598,090,781

The general impression that a "billion dollars was spent for aircraft during the war and that the production program was a failure, not a score of American built planes reaching the front," is finally refuted by figures compiled by *Aviation and Aircraft Journal* from liquidation reports on file in the office of the Chief of Air Service in Washington. The truth is that the actual cost of all war contracts for aircraft, aeronautical equipment, landing fields, foreign purchases, in fact, everything connected with the equipment and maintenance of our air force at home and abroad, cost the taxpayers less than six hundred million dollars.

The actual amounts appropriated for the Army Air Service during the war aggregated \$1,687,054,758. From this total amount there were revoked by Congress, sums aggregating \$487,000,000, making the net amount available for expenditure by the War Department \$1,200,054,758.

Until now the charge has been made and the public has been led to believe that most of this money was spent and largely wasted. It is now revealed for the first time by official and authenticated reports made by the Liquidation Division of the Air Service that of the amount available for expenditure \$582,564,781 has been returned to the United States Treasury.

And there *were* airplanes produced and delivered to the Government, despite the canard that the United States "got nothing for its money." The total amount spent for Army airplanes in the United States was \$113,721,043.39, or 19% of the total Air Service expenditures. For that money the Government received 13,894 American built airplanes. The Government spent \$139,000,000 abroad for training and the purchase of airplanes, engines, construction of cantonments and production centers and received among the other equipment 5,198 complete airplanes, making a total of 19,092 airplanes produced for the United States. These were produced in a period of 21 months. Our production for this period exceeds that of any other country for a like period. It is further substantiation of the belief that the rapidly increasing air power of America forced the war to an early conclusion, for shortly before the Armistice the central powers had only 3309 airplanes on the front. At the signing of the armistice in addition to the 5198 airplanes purchased abroad, 2091 American built airplanes had been shipped to France and 1040 were at points of embarkation or in transit. One thousand four hundred and forty airplanes had been actually received in France, of which 667 American made machines were *actually in service at the front*.

Only within the last few days have these figures been in such form that they could be used in vindication of the war time air service activities of the government. The Chief of Air Service states that figures "have been published and available for public information for several months, *except* the important figures showing net expenditures after liquidation and

the amount of surplus stocks sold or otherwise disposed of." It is therefore with great satisfaction that *Aviation and Aircraft Journal* corrects the gross misstatements of the past two years.

After two years of adjusting canceled war contracts, as previously stated, \$582,564,781 of the \$1,200,054,758 available has been returned to the Treasury.

The amount actually expended from the money appropriated for the War Department for the Air Service, in this country and abroad during the war, was \$617,489,977. From this have been deducted the amounts realized by surplus material sales since the armistice of \$19,399,196, making the net cost of our aeronautical endeavor during the war, \$598,090,781.

The seemingly unanswerable question before investigating committees, Congressional and otherwise, before newspaper writers and the public, has been "what became of over one and one half billion dollars appropriated for our Air Service?"

The answer is found in the following figures which were secured from the office of the Chief of Air Service. This accounting has been necessarily slow. The magnitude of the aircraft program and the multiplicity of its ramifications, both in production and organization activities, in creating an Air Service from nothing to begin with—and it must be borne in mind that preparations were made for a fight to a finish—have made this task of accounting particularly tedious and of long duration. Further, the final accounting could not be made until suspended and cancelled contracts were settled and finally liquidated.

In considering the amount actually spent at home and abroad one must take into account the fact that these expenditures cover all items and that only a comparatively small percentage was spent for airplanes. It is necessary to keep in mind this fact, so that a consideration of future aviation activities may not be warped by prejudice growing out of misconception heretofore circulated about our airplane industry. As will be seen from the figures presented there were expended for Army airplanes and spare parts with the "aeronautic industry" only \$84,704,155.16, or 14% of the total Air Service expenditures. Emergency war organizations received orders for \$29,016,888.23. The total amount spent for Army airplanes in the United States was \$113,721,043.39, or 19% of the total Air Service expenditures.

Looking back over the situation, it now is apparent that our airplane industry *did not fail* during the war. Starting with nothing (as only 142 airplanes had been built for the Army in nine years previous to 1917), it completed and delivered to the government, as shown in detail by the following tabulations, 13,894 complete airplanes, together with spare parts.

The problem, on our entering the war, was to create *both* an Air Service and an aircraft industry. In *both* we succeeded, for on Nov. 11, 1918, the Air Service consisted of 20,568 officers and 174,456 enlisted men and civilian personnel, and 48 flying fields in operation.

In addition to airplanes for the Army our aircraft industry during this period, manufactured a large number of seaplanes and flying boats, for the Navy. It is a significant fact that during all of this period, while there has been almost constant discussion of our "failure in aviation," practically all the criticism has been directed toward the work of the War Department. Most of the Navy's contracts for procurement of seaplanes and flying boats, etc., were placed with the aircraft industry and officers in the Navy Department credit the industry with having met their requirements promptly and regularly.

The production of engines as shown by the final statements is also highly

creditable. There was spent for aeronautical engines \$244,838,162.30 in this country and 41,953 engines and spare parts were produced and delivered.

From these revised figures, it must be conceded that the American airplane industry gave a splendid account of itself during the war. There may be a difference of opinion as to the adaptability of the American made machines to meet the requirements of the service, but it must be remembered that the airplane manufacturers could make only the machines that they were ordered to make and that during the war period no attempt was made by the War Department to produce planes of American design, the sole effort toward original design and production being centered on the Liberty engine.

It is due perhaps more to the advice of our Allies than to our advisers in Washington that more American made airplanes did not reach the front earlier. When the United States entered the war, our Allies urged that we first furnish raw material, mechanics and train aviators. Types of aircraft were changing every few months. A new type on either side with a few miles more speed, greater maneuverability or greater carrying capacity would render all previous designs obsolete. Under such conditions it was obvious that any American production program should be based on European experience and advice.

That the above facts may be verified from official sources the following statements are printed in original form.

April 6, 1921.

MAJOR LESTER D. GARDNER,
c/o *Aviation and Aircraft Journal*,
225 Fourth Avenue,
New York City.

Dear Sir:—

In response to your inquiry as to the exact amount of aeronautical appropriations made by Congress during the war period, accompanied by an additional statement showing the amount actually expended from these appropriations, and in a general way the purposes for which the expenditures were made, the Chief of Air Service directs me to advise you as follows:

There is enclosed herewith a statement, File Number A 00.3/53, showing all aeronautical appropriations for U. S. Army from 1917 to 1918, inclusive, giving (after revocations made by Congress) a net total of \$1,200,054,758.

Of this total amount there has been disbursed or reserved for final settlement of all claims to March 31, 1921, the sum of \$617,489,977.

This sum, \$617,489,977, is the gross amount expended for all of our aeronautic activities from the appropriation for the war period above mentioned. Your attention is directed to the fact that this includes nearly \$2,000,000 that has been reserved to cover three remaining contracts, not yet liquidated.

From surplus stocks, there has been sold, since the war, aeronautical property bought under these appropriations, on which the War Department has realized a cash return of \$19,399,196. In addition to the actual sale of surplus material, there has been transferred, without funds, to other governmental departments property to the value of \$5,139,315.33. There remains yet to be disposed of other property declared surplus, to the value of \$15,931,930.37. Disregarding any cash returns that may be realized from future sale of the latter, as well as the transfers to other departments, but de-

ducting the sum already received from sales (\$19,399,196), it will be seen that the net cost of our aeronautical endeavor during the war, according to the present figure, is \$598,090,781.

There is also included in the above-mentioned statement a tabulation covering the disbursements for the procurement of airplanes, aeronautical engines, balloons and airships arranged according to industries. The figures contained in this statement are taken from "Aircraft Surveys," House Document No. 621, 66th Congress, and show figures as of Nov. 1, 1919. These figures were prepared for Congress one year after the Armistice, and after all deliveries had been completed. They have been, in some cases, slightly modified by final liquidation of contracts, but a complete analysis of liquidated figures is not immediately available. All these, however, are included in the final liquidation, and covered in the preceding paragraph.

There are also embodied in the same statement, figures showing other items of expenditure from these war aeronautic appropriations. The figures on this statement are taken from the figures submitted to Congress by the Air Service, and published in Part II, of "United Air Service, Hearing before a Subcommittee of the Committee on Military Affairs, House of Representatives, 66th Congress, 2nd Session." With these figures before you, you will be able to determine the purpose for which the \$617,489,977 was spent. These figures, as above indicated, are not in each case final, as they were prepared before liquidation, but they are sufficiently accurate for practical purposes in considering this question.

The subjects of your inquiry cannot be properly considered, however, without reference to the further fact that in addition to the stocks declared surplus and sold or offered for sale since the war, we hold, as additional salvage from war expenditures, much other aeronautical equipment constituting a national asset, such as complete airplanes, extra engines, balloons and other equipment, now in use or reserved for future use of the service. In addition to this equipment, and probably the greatest asset, from the war, are the thousands of trained flying officers and mechanics, together with our training fields, hangars and other ground facilities. All of the figures contained in the above have been published and available for public information for several months, except the important figure showing net expenditures after liquidation and the amount of surplus stocks sold or otherwise disposed of.

Very respectfully,

H. M. HICKAM,
Major, Air Service,
Chief of Information Group.

WAR AERONAUTICAL APPROPRIATIONS U. S. ARMY, 1917-1918

The following information sets forth the appropriations specifically provided by Congress in the various bills listed. The actual total amount for the bills will vary for some of these figures, as the bills included appropriations for the purposes of the Signal Corps proper, as well as for aeronautics in the Signal Corps.

These figures show the allotments made to cover purchases and contracts, and are not figures representing actual disbursements. It is practically impossible to secure figures on the actual disbursements under each and every class of material or service paid for from Air Service records only.

The figures for the allotments and unallotted balances in this tabulation were obtained from "United Air Service," "Hearing Before a Sub-committee of the Committee on Military Affairs, House of Representatives, Sixty-sixth Congress, Second Session," statement of Lieut. Col. Jacob E. Fickel, Air Service, pages 162 et seq., with the exception of the item of \$8,000,000.00, the allotments under which are not shown in the hearings.

As the statements in the hearings of the date of June 30, 1919, show, the allotments include monies not only, therefore, actually disbursed for aircraft material, accessories and services, but include also funds reserved for settlement of cancelled or suspended contracts.

It will be seen from the statements in the hearings that it is practically impossible to arrive at figures which show the actual monies disbursed for purely aeronautical purposes; e.g., Page 168, item 3, some of these telephone systems were installed at Air Service stations. Under Par. 4, some of this radio equipment was for the Air Service. Paragraph 5 includes also transportation for the Air Service. However, in the attached tabulation, there have been included only those allotments specifically named as for the Air Service.

On page 169, the items under "Aviation, Seacoast Defenses," "Aviation, Seacoast Defenses, Insular Possessions, Hawaii," or "Aviation, Seacoast Defenses, Insular Possessions, Philippines," include monies appropriated for aeronautics, prior to the declaration of war, which monies were partially used during the war, and even in 1921.

Other items in these hearings include purely Signal Corps allotments, which have no relation to aeronautics.

Reference is made, in this connection, to the document, "Consolidated List of Aircraft Contracts and Deliveries, April 6, 1917, to Nov. 1, 1919," file number A-10.2/22, compiled in the Information Group, O. C. A. S., after making minor corrections in "Aircraft Surveys" House Document No. 621 included as an appendix herein. The figures shown in this statement represent actual disbursements, as of Nov. 1, 1919. The document does not include settlements made subsequently which change the actual final payments to the aeronautical industries and to outside industries for aircraft material. This document is mentioned in order to explain the discrepancy in the figures between those shown therein and the figures shown in the hearings above mentioned.

The allotments under the appropriation of \$8,000,000.00 were supplied by the Liquidation Division, O. C. A. S. The items mentioned in the attached tabulation as unallotted balances were returned to the Treasury.

The concluding statement attached, which purports to show the total actual disbursements, was compiled March 26, 1921, by the Liquidation Division.

So that the items of all war time Government appropriations may be clearly understood the following official detailed tabulation is furnished:

WAR AERONAUTICAL APPROPRIATIONS U. S. ARMY.

Act May 12, 1917	\$10,800,000
Act Oct. 6, 1917	40,000,000
Act June 12, 1917	500,000
Act of June 15, 1917	43,450,000
Act of July 24, 1917	640,000,000
Act of July 8, 1918	8,000,000

AIRCRAFT PRODUCTION COST, 1917-1918 185

Act of July 9, 1918	760,000,000	
Act of July 9, 1918	124,304,758	
Act of Nov. 4, 1918	60,000,000	\$1,687,054,758

Less revocations		487,000,000
		<u>\$1,200,054,758</u>

Following is a tabulation, appropriation by appropriation, with the allotments for aeronautics, unallotted balances and revocations shown under each.

Appropriations		Allotments Unallotted Balances Revocations
\$10,800,000		
40,000,000		
	Allotments	\$8,293,128.73
	Used by S. C. proper	40,506,871.27
	Revocation	2,000,000.00
		<u>50,800,000.00</u>
50,800,000		
	Allotments	480,764.67
500,000	Unallotted balance	19,235.33
		<u>500,000.00</u>
500,000		
	Allotments	
43,450,000	Unallotted balance	32,144,975.49
	Used for S. C. proper	11,305,024.51
		<u>43,450,000.00</u>
43,450,000		
	Allotments	606,872,404.10
640,000,000	Unallotted balance	33,127,595.90
		<u>640,000,000.00</u>
640,000,000		
	Allotments	4,858,591.48
8,000,000	Unallotted balance	3,141,408.52
		<u>8,000,000.00</u>
8,000,000		
	Revocation	400,000,000.00
760,000,000	Allotments	288,164,487.41
	Unallotted balance	71,835,512.59
		<u>760,000,000.00</u>
760,000,000		
	Revocations	85,000,000.00
60,000,000	Allotments	91,935,311.81
124,304,758	Unallotted balance	7,369,446.19
		<u>184,304,758.00</u>
184,304,758		

Suspension uncompleted portions of contracts at time of armistice	509,199,915.99
Settled since war to Mar. 25, 1921.....	93,940,229.30
Bal. returned or to be returned to Treasury.....	415,259,686.69
Total appropriations	1,200,054,758.00
Less amount for suspension contracts	509,199,915.99
	690,854,842.01
Less unallotted balance and S. C. proper as above.....	167,305,094.31
	523,549,747.70
Add disbursements since armistice	93,940,229.30
Grand total disbursements	617,489,977.00
Total appropriations	1,200,054,758.00
Disbursements, including \$1,789,000 held for settlement of 3 contracts outstanding, 31 March, 1921.....	617,489,977.00
Savings returned to Treasury	582,564,781.00
Cash received from disposal of property declared surplus...	19,399,196.00
Actual cost air endeavor in war	\$598,090,781.00

APPENDIX I

CONSOLIDATED LIST OF AIRCRAFT CONTRACTS AND DELIVERIES IN U. S. APRIL 6, 1917—NOVEMBER 1, 1919

AIRPLANES—ENGINES—AIRSHIPS—BALLOONS (SUPPLY, FREE, TOY, OBSERVATION, TARGET, PROPAGANDA, EXPERIMENTAL)

Arranged by Industries and by Contractors

Rearranged from corrected copy of "Aircraft Survey," House Document No. 621, 66th Congress, 2nd Session, on file in Office, Chief of Air Service, to show the amounts paid to each contractor, divided between the Aeronautical, Automobile and Kindred, and Miscellaneous industries. Only disbursements to November 1, 1919, are shown: consequently, settlements in liquidation of suspended contracts are not included. The above document is public and for all practical purposes shows the amounts expended for flying material.

Those concerns which were producing airplanes, aircraft engines, balloons or airships prior to the World War and generally accepted as pioneer aeronautical manufacturers, and those other concerns organized during the war period and who are continuing active operations in aeronautics, have been considered in the classification "Aeronautical Industry."

AIRPLANES

Aeronautical Industry

Number Received	Amount
4014 Curtiss	\$ 29,366,397.24
1033 Standard	15,589,694.63

AIRCRAFT PRODUCTION COST, 1917-1918 187

Number Received	Amount
1 Sturtevant	11,250.00
51 Wright	329,250.00
131 L. W. F.	1,649,377.50
10 Glenn Martin	822,575.27
599 Thomas-Morse	3,106,103.27
7 Lewis & Vought	61,676.00
2 Heinrich	11,328.00
4 Gallaudet	140,013.02
300 Breese	591,325.85
1 Burgess	26,009.50
0 Aeromarine .....	.....
50 Fowler	323,166.90
3506 Dayton-Wright	31,446,575.88
25 Packard	1,084,670.12
8 Ordnance	144,742.98
	\$84,704,155.16

Automobile and Kindred Industries

2000 Fisher	19,643,837.39
0 Brewster	200,000.00
	\$19,843,837.39

Miscellaneous (Emergency War Organizations, New Concerns, Missions, etc.)

0 Empire	\$15,000.00
3 Pigeon-Fraser	19,075.00
200 Liberty Iron Works	1,002,366.28
1 Italian War Mission	49,227.79
2 Equipment Holding	10,000.00
588 Springfield Aircraft Co.	3,457,229.52
450 St. Louis	2,137,500.00
50 U. S. Aircraft Co.	326,170.10
75 Howell & Lesser	394,121.41
1 Schiefer	11,720.00
100 Various mfrs. for Handley-Page Parts .....	.....
680 Canadian Aero Co.	1,733,136.00
2 Pacific	17,504.74
	\$9,173,050.84

Recapitulation of Airplanes

9742 Aeronautical Industry	\$84,704,155.16
2000 Automobile and Kindred Industry	19,843,837.39
2152 Miscellaneous	9,173,050.84
	\$113,721,043.39

ENGINES

Aeronautical Industry

Number Received		Amount
2	Ordnance*
1	Lawrance	\$21,000.00
1255	Hall-Scott	2,944,631.03
750	Curtiss	634,547.23
41	Standard	215,093.14
94	L. W. F.*
73	Sturtevant	*302,000.00
30	Burgess	133,500.00
5816	Wright	54,372,268.68
69	Thomas-Morse	321,990.08
4	Gallaudet*
6630	Packard	42,780,339.50
<hr/>		
14765		\$101,725,369.64

Automobile and Kindred Industries

4	Van Blerck	\$8,913.04
4	Sterling	11,680.59
2	Wisconsin	2,878.00
40	Duesenberg	4,934,798.62
0	Pierce Arrow	1,584,164.81
2543	General Motors	9,766,499.68
8500	Willys-Overland	21,030,871.60
61	General Vehicle	43,700.00
451	Excelsior Motor	295,000.00
2000	Nordyke & Marmon	18,015,240.38
1	Winton	1,485.00
1	Trego	1,145,008.11
6500	Lincoln	45,859,985.18
3950	Ford	29,401,393.62
1	Willys-Morrow	400.00
<hr/>		
24058		\$132,102,018.63

Miscellaneous

400	Canadian Aero	\$252,000.00
121	Aero Engineering	523,723.14
1	Schiefer*
4	Italian War Mission*
8	British War Mission .....	.....
2585	Union Switch	10,131,298.89
6	Murray & Tregurtha	103,752.00
3	Equipment Holding*
2	Pacific*
<hr/>		
3130		\$11,010,774.03

* Amounts wholly or partly included in same contracts covering airplanes.

AIRCRAFT PRODUCTION COST, 1917-1918 189

RECAPITULATION OF ENGINES

Number Received	Amount
14765 Aeronautical Industry	\$101,725,369.64
24058 Automobile & Kindred Industry	132,102,018.63
3130 Miscellaneous	11,010,774.03
41953	\$244,838,162.30

BALLOONS AND AIRSHIPS

Aero Industry

128 Connecticut	\$393,464.10
28 Knabenshue	198,501.66
1 Fr.-American	1,800.00
687* Goodyear	4,160,588.19
844	\$4,754,353.95

Automobile Industry

249 Goodrich	\$1,788,253.94
6437 U. S. Rubber	428,252.68
7 Firestone	76,223.56
2275 Revere	2,030.63
8968	\$2,294,760.81

Miscellaneous

3 Halsey	\$1,185.24
161 Scott	18,579.71
1 Columbia	60.00
22866 (pilot balloons) Faultless	1,608.30
44 Navy Dept.	70,000.00
8500 (pilot balloons) Sterling	8,735.00
31,575 Total	\$100,168.25

Recapitulation of Balloons

41387 Total Balloons & Airships	
Total Expenditure	\$7,149,283.01

APPENDIX II

DISPOSAL OF SURPLUS MATERIAL

Following is a statement of aeronautical material declared surplus in the U. S. Army Air Service and disposed of, as of March 23, 1921. (Memorandum to Information Group from Acting Chief, Material, Disposals and Salvage Division, March 31, 1921.)

* Includes one airship.

Total value declared surplus (cost to Government)		\$103,412,028.07
Value of Material Disposed of (cost to Government)		
Adjustments, Wastage, Depreciation	\$4,403,240.83	
Material absorbed in settlement of claims...	6,372,000.00	
Transferred to other Air Service activities..	17,205,367.06	
Transferred to other Government Depart- ments—no funds	5,139,315.33	
Total sold—		
Government Dept's	19,380.52	
Commercial	54,340,893.96	54,360,274.48
		87,480,197.70
Percentage of amount disposed of	84.59	
Actual receipts for amounts disposed of		19,399,196.00
Value of remainder yet to be disposed of (cost to Govt.)....		15,931,830.37

OTHER EXPENDITURES

The above figures account for \$365,708,485.30 of the total wartime aeronautical expenditures for the Army as follows:

Airplanes	\$113,721,043.39
Engines	244,838,162.30
Balloons	7,149,283.01
	<hr/>
	\$365,708,488.70

This leaves \$251,781,488.30 to be accounted for in the expenditures for other purposes.

Below are figures which will show these main expenditures in concrete form:

Training Stations

30 Flying schools and fields	\$ 55,587,422.74
5 Balloon schools	2,510,496.01
1 Aerial photo school	1,200.00
1 Radio school and laboratory	486,350.00
1 Aero gunnery school	380,000.00
1 Mechanics' school	158,900.00
8 Warehouses and depots	5,114,041.67
3 Engine repair depots	1,962,120.00
3 Concentration camps	2,406,700.00
5 Acceptance parks and experimental station	641,533.50
3 Sundry stations	479,154.55

\$ 69,727,918.47

Rental for flying fields, schools, depots, rights of way, buildings, warehouses, wharves (acreage owned by U. S. not included in these figures)

709,899.72

Foreign expenditures (estimated) for airplanes, engines, fields and other purchases

139,000,000.00

(p. 184, United Air Service Hearing, Part 2)

Miscellaneous:

Pay of personnel, officers, enlisted men and civilians, machine guns, ammunition, bombs, cameras, flying clothing and other purchases	42,343,670.11
	\$251,781,488.30

WHAT \$598,090,781 BOUGHT IN WAR AVIATION

The final official account of the work of our air service at home and abroad is now available. In last week's issue a detailed statement was published of the War Aviation appropriation showing \$582,562,781 has been returned to the United States Treasury. The detailed cost of our War Aviation during 1917 and 1918 is also now made public for the first time through the compilation of liquidation reports by *Aviation and Aircraft Journal*. The official statement follows.

ACTIVITIES AT THE FRONT

"American flying officers, with the American armies, with the Royal Air Force, with the Independent Air Force, with the French and with the Italians destroyed 781 airplanes and 73 balloons, a total of 854 enemy aircraft, actually confirmed; it being impossible to furnish records of non-confirmed successes of which there were many. The American losses in airplanes and balloons to the enemy were 289 airplanes and 48 balloons, a total American loss of 337. The superiority of the American Air Service is shown by the confirmation of almost three times as many enemy airplanes shot down as American airplanes lost to the enemy; and nearly twice as many balloons. The actual battle fatalities of the entire U. S. Air Service personnel with the American, British, French and Italian armies for the entire war, was 227. It is not possible, of course, to know the exact number of fatalities of the enemy incurred in their loss to the Americans of 854 airplanes and balloons, but it may be assumed that the majority of these airplane losses represent fatalities.

"American airplane pilots spent 35,747 hours over the lines, participated in 150 bombing raids on the western front, dropping 255,000 pounds of explosive. The 37 squadrons in operation in the first and second American armies whose flying hours for pilots are given herein, flew 966 hours per squadron, although these units had been at the front varying periods from 1 day to 7 months. The American hours nearly equal the hours flown by the Belgians during the entire war. The British squadrons flew 1292 hours per squadron, on all fronts, active and inactive. One thousand six hundred and forty-two balloon ascensions were made by American flying officers in the Zone of Advance, with a total of 3111 hours. These balloons made 316 artillery adjustments and were attacked 89 times by enemy aircraft. One hundred and sixteen parachute drops were made from balloons. The aerial observers employed in photography made 17,854 photographs of enemy positions and distributed for interpretation and other purposes 585,000 prints. The activities of the Air Service in training and at the front were carried on from 73 airdromes in the Zone of Advance alone. Nearly 600 American and foreign decorations were awarded to Air Service officers and soldiers up to May 1, 1919, and the list has been increased since.

PERSONNEL WITH THE ARMIES

"On the day of the Armistice, there were 45 American squadrons and 23 balloon companies assigned to American armies and to the French, Italian and British Air Forces. Twelve of these squadrons had American made DH-4 airplanes. There had been sent 1230 pilots and 749 observers to the American Zone of Advance. There were actually at the American front on Armistice day 767 pilots and 481 observers, as well as radio and other specialists, both flying and non-flying, and 172 pilots and 20 observers at the front with the allied air forces, not to mention other personnel. Other flying officers were, of course, in reserve and in training. Thirty-five balloon companies were in the A.E.F. on Nov. 11, 1918.

FLYING TRAINING

"During the war period there were commissioned in the Air Service, both flying and non-flying, a total of 20,708, of which 12,449, over 60%, were trained for flying duty as airplane pilots, balloon pilots, airplane and balloon observers, airplane gunners, bombardiers, etc. In this training, for the fiscal years 1917-18 only, not to the end of training even, there were flown in the United States 909,606 *airplane* hours, with a total of 331 fatalities, a ratio of 1.09, and .346 fatalities per 1000 hours flown in 1917-18 respectively. In the A.E.F. there were flown a total of 193,193 hours in training with 169 fatalities for the entire period of training, a ratio of one fatality to 1143 hours flying. Of the airplanes received in the A.E.F. 2948 were sent to training centers and 2925 to the Zone of Advance to December 31, 1918.

PRODUCTION AND PURCHASE A.E.F.

"Of the 45 American squadrons on Armistice date, 33 squadrons were equipped with foreign made airplanes, in addition to which individuals operating with the Italian, French and British forces used machines of these countries respectively. Twelve squadrons were operating or equipping with American DH-4's, and equipment was on hand, both foreign and American, for further squadrons as they could complete training, organize and get to the front. On Armistice day there were 740 airplanes actually with the American armies, of which 196 were American DH-4's, with 502 in reserve. One thousand four hundred and forty-three DH-4's were received in France, sufficient to supply the unit equipment of 24 planes, without wastage, for 60 squadrons. Including automobiles, trucks, motorcycles, etc., there were purchased by the Air Service 3065 pieces of transportation equipment. Of the 602 hangars on hand, 414 were from the United States, and 388 from France and England.

"One thousand eight hundred and eighty-eight airplanes had been outfitted with radio equipment; 1444 airplanes had been armed. There were 9232 machine guns on hand, besides those installed in airplanes.

"There had been received in France to Dec. 31, 1918, 6639 airplanes (4886 from France, 291 from England, 19 from Italy, and 1443 from the United States). Seventy-seven balloons had been sent to the balloon companies on the front, 57 of which were American made, with others in reserve.

Above is the official record of the achievements of our Air Service with the A.E.F. and at home. Volumes have and many more will be written of the heroic work of our pilots. But every time our activities in the air during the war are mentioned, the public recalls the oft repeated statement

by uninformed persons "that the United States spent a billion and a quarter dollars for aviation and got nothing for its money."

In last week's *Aviation and Aircraft Journal* there was presented for the first time the fact that \$582,562,781 of the wartime aviation appropriations remained unspent and has been returned to the treasury. The cost to the taxpayers was therefore, according to the present figures after the Liquidation Boards had finally reported, \$617,489,977.

It is practically impossible to find out the exact cost of every item that was purchased, as so many different departments bought for the Air Service at such varying prices. What everyone who looks back at our aircraft activities does want to know is what the government received for the vast sum. It is believed that this information is gathered together in a condensed report and presented for the first time in the following tables.

First are shown the expenditures in the United States. From this tabulation, it will be seen that out of \$478,489,977 spent in the United States only \$113,721,043.39 was spent for airplanes. The engines being ordered in such large quantities have to be considered separately as so many more were constructed than airplanes. The sixty-one American fields, schools and depots are shown in detailed cost. As will be seen from the huge quantities of materials ordered it would be a gigantic accounting task to secure the exact amount spent for each item, therefore they are grouped under the total of \$41,817,220.11.

Below is given the cost of our Air Service in the United States in detail from figures compiled by *Aviation and Aircraft Journal* from official reports:

AIR SERVICE EXPENDITURES IN UNITED STATES

9,742	Airplanes from Aero Industry.....	\$84,704,155.16	
2,000	Airplanes from Auto and Kindred Industries	19,843,837.39	
2,152	Airplanes from Miscellaneous	9,173,050.84	\$113,721,043.39

13,894

(Airplanes considered as without engines)

14,765	Engines from Aero Industry	101,725,369.64	
24,058	Engines from Auto and Kindred Industries	132,102,018.63	
3,134	Engines from Miscellaneous	11,010,774.03	244,838,162.30

41,953

(Includes all engines, in or out of airplanes)

844	Balloons and 1 Airship from Aero Industries	4,754,353.95	
8,968	Balloons from Auto Industry	2,294,760.81	
31,575	Balloons from Miscellaneous	100,168.25	7,149,283.01

41,367

(Includes free and observation passenger balloons, and pilot, supply, target and propaganda balloons and 1 airship.)

30	Flying Schools and Fields	55,587,422.74	
5	Balloon Schools	2,510,496.01	
1	Aerial Photo School	1,200.00	
1	Radio School and Laboratory	486,350.00	

1	Aerial Gunnery School	380,000.00	
1	Mechanics School	158,900.00	
8	Warehouses and depots	5,114,041.67	
3	Engine Repair Depots	1,962,120.00	
3	Concentration Camps	2,406,700.00	
5	Acceptance Parks and Experiment Station	641,533.50	
3	Sundry Stations	479,154.55	\$69,727,918.47

61

(Above figures for Construction)

	Rentals for flying fields, schools, depots, rights of way, buildings, warehouses, wharves, etc. (22,912 acres, not including floor space in offices, etc.)	709,899.72
	Helium experiments and plants, Nos. 1, 2, and 3 (Army share).	526,450.00
282,426	Air Pressure and Gasoline Gauges, Air Speed Indicators, Altimeters, Clocks, Compasses, etc.	
98,555	Machine Guns	
19,786	Synchronizing Devices	
15,122	Flexible Ring "A" Gun Mounts	
44,652	Gun Light Parts	
20,078	Gun Yokes, Controls, Light Mounts	
227,595	Dummy and Loaded Bombs	
11,630	Mark I Bomb Sights	
249	Barlow Heavy Bomb Releases	
10,213	Bomb Releases and Parts	
14,542	Flares and Releases	
1,051	Cameras	
465	Enlarging Lanterns	
1,599	Camera Guns	
1,159	Photo Cradles	
3,968	Steel and Canvas Hangars	
3,429	Tons Ferrosilicon and Caustic Soda	
172,800	Hydrogen Cylinders	
236	Balloon Winches	
3,310,000	ft. Balloon Cable	
13,673,000	yds. Airplane Fabric	
7,888,000	yds. Balloon Fabric	
7,359,000	yds. Cotton Tape	
676,000	gals. Acetate Dope	
86,000	gals. Nitrate Dope	
643,240	Miscellaneous Clothing	
42,424	Propellers	
82,159,751	gals. Oil	
249,612,095	gals. Gasolene	
36,600,000	cu. ft. Hydrogen Gas	
107,635,000	bd. ft. Lumber from Mfrs. and other Miscellaneous items	
		\$478,489,977.00

TOTAL EXPENDITURES IN UNITED STATES \$478,489,977

The figures showing the purchases abroad for the A. E. F. are the first that have ever been presented giving costs and items. The \$139,000,000 was allotted to so many different projects that it has taken two years to reach a settlement with foreign governments and companies. As the latest figures show, \$19,949,769.28 was spent for 5,229 airplanes. For airplane spare parts \$7,490,114.23 was used. Hangars, tents and other shelters cost \$8,228,116.38.

There were thirty-one American fields, depots and parks constructed and equipped overseas. As will be seen in the figures below it is impossible even now to segregate all the items as has been done in the United States accounting, as the figures are probably scattered in so many places that only the sums expended by the different offices are yet obtainable.

The miscellaneous expenditures in France, England, Italy and other countries total over \$60,000,000.

AIR SERVICE EXPENDITURES FOR A. E. F.

4,879	Airplanes from France	\$18,253,628.82	
283	Airplanes from England	1,210,419.30	
68	Airplanes from Italy	485,271.16	
<hr/>		<hr/>	
5,229	Airplanes		\$19,949,769.28
6,400	Engines from France	18,903,828.11	
215	Engines from England	1,304,110.30	
444	Engines from Italy	2,361,883.23	
<hr/>		<hr/>	
7,059	Airplane Spare Parts from France	7,297,431.89	22,569,821.64
	Airplane Spare Parts from England	162,315.12	
	Airplane Spare Parts from Italy	30,367.22	7,490,114.23
<hr/>		<hr/>	
	Engine Spare Parts from France	7,547,464.97	
	Engine Spare Parts from England	122,325.21	
	Engine Spare Parts from Italy	51,230.00	7,721,020.18
	Instruments from France and Italy		459,133.92
	Propellers from France and Italy		240,270.10
	Squadron Equipment from France and Italy		2,210,887.77
	20 Balloons, 60 Winches, Equipment and Supplies from France		2,100,000.00
	Armament from France for 2054 airplanes...	759,980.00	
	Armament from Italy, Misc.	9,115.15	769,095.15
<hr/>		<hr/>	
	Hangars, Tents, Abris, Canvas, etc.		
	From France	1,881,330.28	
	From England	6,406,786.08	8,288,116.36
<hr/>		<hr/>	
	Radio Equipment from France		1,062,543.11
	Photo Equipment and Supplies		287,713.22
	Photo Transportation Equipment from France (75 Vehicles)		595,550.37
	Dope (3480 gals.) and Cellulose, Acetate (17.5 tons) from		
	France and England		179,995.55

Special Clothing from France and Italy	28,288.66
Signal Equipment Supplies from France	619,437.19
Castor Oil, Gasoline, etc., from England	1,329,675.13

Construction of:—

11 Flying and Balloon Schools	\$ 5,256,974.65
7 Airdromes	2,344,296.25
8 Depots	1,977,890.92

Miscellaneous Projects:

1 Warehouse	119,725.49
1 Acceptance Park	1,030,469.45
1 Assembly Plant	5,147,139.27
1 Replacement and Concentration Bar- racks	162,940.18
1 Test Field	112,838.26

\$16,152,274.47

31

Miscellaneous:—

Includes motor transportation, small tools, machinery, shop equipment, steel products, miscel. supplies and equipment for general operations, shells, tool kits, boxes, cases, etc.

France	\$23,006,324.22	
England	1,337,176.66	
Italy	18,497,488.88	
Switzerland	147,831.19	
Spain	309,973.71	43,298,794.66
Other Miscellaneous Items		19,799,773.58

Total Expenditures for A.E.F. \$139,000,000.00

RECAPITULATION

Expenditures in U. S.	\$478,489,977.00
Expenditures in A.E.F.	139,000,000.00
Total War Aviation Expenditures	617,409,977.00
Actual receipts for Materials sold	19,399,196.00
Net Cost of War Aviation	598,090,781.00

FOREIGN SUBSIDIES FOR CIVILIAN AVIATION

<i>Country</i>	1919	1920	1921	1922
Algiers	*1,000,000 francs
Australia	£25,000	£54,000	.....
Belgium	1,000,000 francs	1,600,000 francs	3,000,000 francs
Czecho-Slovakia.	3,200,000 kr.	6,000,000 kr.
France	1,640,267 francs	8,000,000 francs	31,700,000 francs	45,382,000 francs
Germany	500,000 marks	12,000,000 marks	*21,000,000 marks	.....
Great Britain....	£81,000	£200,000
Italy	4,500,000 lire	.....
Japan	50,000 yen	.....
Netherlands	100,000 fl.	200,000 fl.	*370,000 fl.
Roumania	6,500,000 leis	.....
Switzerland	150,000 francs

* Proposed.

(In the United States there is no subsidy for civilian aviation.)

REPORT OF COMMITTEE ON AIRCRAFT TO CONFERENCE ON LIMITATION OF ARMAMENT

FORM OF PROCEDURE

1. In considering the limitation of aircraft as to numbers, character and use, the committee on aircraft adopted a form of procedure which took up the various questions involved in the following order: (1) Commercial aircraft; (2) civil aircraft; (3) military aircraft. Heavier-than-air and lighter-than-air craft were considered separately since the conditions governing the two are not in all cases the same. An effort was made to determine whether or not it is possible to impose limitations upon their (1) number, (2) character, (3) use, and after discussion of the methods that might be employed to effect such limitation, whether limitation was practicable or not. This committee feels that the desirability of placing any limitations whatever upon aircraft is a matter of policy, one which it is for the main committee itself to determine. Nevertheless, it feels it to be a duty to point out the essential facts which will have a decided bearing upon the determination of the proper policy to be adopted, and this is done in this report.

COMMERCIAL AIRCRAFT

2. Different methods of imposing such limitation may be adopted by different States. The precise methods adopted by any State must be in conformity with its organic law. In some States it may be possible to impose an arbitrary limitation; in others, by the exercise of the police power, or of the power to tax, a practical limitation may be enforced. In the United States, where laws passed by Congress must conform to the written Constitution of the country, there may be some difficulty in finding an effective means of imposing this limitation, but nevertheless it is believed that if necessary, such means can be found.

3. Before discussing any other phase of the matter it will be well to consider carefully the effects which would follow the imposition of the limitation upon the numbers and characters of commercial aircraft which may be owned and operated by the nationals of a State. In the first place, if commercial aeronautics is allowed to follow the natural laws which have governed the development of all other means of transportation and communication, the number and character of such aircraft will probably depend on financial considerations. That is, commercial aeronautics as a business will not thrive unless the operation of the aircraft will return a substantial profit. The State may interfere with the operation of these natural laws by granting to the owners and operators of such aircraft a direct or indirect subsidy. By so doing enterprises which would not otherwise be financially successful may be enabled to live and in this way the number of aircraft used for commercial purposes will be greater than if the natural laws of development had been allowed to take their course.

ARMAMENT CONFERENCE REPORT ON AIRCRAFT 199

CANNOT BAR PROGRESS

It is not easy to foresee what consequences to human progress will come in the future from the development of aeronautics in all its branches. They will certainly be marvelous where natural conditions are favorable to such development. To try to limit them now with arbitrary laws, even if these laws have the purpose of preventing war, would be in the opinion of this committee disastrous from the point of view of world progress.

4. If, among commercial aircraft, we class those owned and operated for sport, or pleasure, or convenience, the numbers of these will depend largely upon the wealth of the nation, upon the inclination of the people toward aeronautics, upon the cost of the aircraft thus employed.

LESSEN CAUSES OF WAR

5. The development of aircraft has presented the world with a new and improved means of transportation and communication. One of the causes of warfare in the past has been a lack of the proper distribution of the world's resources in raw material, food products, and the like. Another potent cause of war has been the lack of understanding between races, peoples and nations. Any addition to the transportation and communication facilities of the world should operate to improve the distribution of resources and likewise to lessen the causes of misunderstandings between peoples, and thus lessen the causes of warfare. Any limitation, therefore, placed upon commercial aeronautics would have the effect of limiting a means of transportation and communication between the different parts of the same state and between different states. It seems inconceivable that any limitation should be imposed upon commercial aeronautics unless it were with the avowed object of thereby limiting the air power of a state and thus decreasing the liability of war. Commercial aeronautics with its attendant development of an aeronautical industry and a personnel skilled in the manufacture, operation, and the maintenance of aircraft does furnish a basis of air power. The development of commercial aeronautics and the development of a nation's air power are inseparable.

AIRCRAFT NOW SPECIALIZED

6. Speaking broadly, all aircraft will be of some military value no matter what restrictions may be placed upon their character. Some can probably be converted with but few changes into military aircraft; others can be designed so that with major or minor alterations, or even with none at all, they can be employed for military purposes. As a matter of fact, the uses of aircraft in war are many. During the world war highly specialized types were designed for special uses. Military aircraft have likewise been developed to a degree of perfection not yet reached in commercial aircraft. It is quite reasonable to suppose that similar development will take place in commercial aircraft; that they too will be especially designed for the uses to be made of them, and that they may depart quite radically from the military types used in the world war.

COST MAY LIMIT PLANES

In military aircraft, as a rule, a premium is placed upon performance. Consideration of initial cost, of cost of operation and of maintenance are

largely disregarded. The safety and convenience of the operators and passengers are considered only as these affect their ability to perform their military duties. If, as seems evident, commercial aircraft must be especially designed for the service they are to perform in order to have a chance of being financially successful, any effort to provide for their conversion into military craft will introduce complications which will increase the cost of production and operation. This may itself automatically act as a limitation, for business enterprises will not be willing to have such conditions imposed unless they are compensated in some way for the extra cost.

7. HEAVIER-THAN-AIR

The war value of an aeroplane may be said to lie in a combination of two or more of the following characteristics:

- (a) Its suitability for offensive and defensive equipment.
- (b) Its radius of action.
- (c) Its speed.
- (d) Its carrying capacity.
- (e) The height it can attain.

It is not desired to go too deeply into technical matters in this report. The committee wishes, however, to point out that the peace value of aircraft is at present intimately bound up with the general characteristics which make up the value of the airplane in war. The last four of the characteristics enumerated above are dependent upon the relation between the amount of fuel carried, the horse-power of the engine, the lifting surface and the total weight. The committee is of the opinion that formulæ could be evolved defining the interrelationship of these factors in such a way as to limit the war value of the machine built in conformity therewith. It is more difficult to insure that war equipment shall not be mounted in a commercial aeroplane. In this matter the committee is of the opinion that definite rules can not be laid down.

RADIUS OF ACTION VITAL

Radius of action is of high commercial value. A reliable air service from Europe to America in, say, 24 hours, should prove a highly profitable undertaking. Again, in countries where there is perhaps the greatest scope for the development of airways, countries of great deserts, for example, radius of action is essential. Speed is plainly the characteristic on which aircraft rely to gain advantage in their competition with other means of transportation. It is not yet comfort and security but time-saving that will tempt passengers, mails and valuable cargoes from old established services. To limit speed is to stop progress, to throttle aviation in its infancy.

The power of carrying numbers of passengers or quantities of goods is of obvious commercial value and even the attainment of considerable heights may eventually be a definite requirement. As a matter of fact, the success of recent experiments indicates that, with special means of supercharging motors, navigation of the air will in the future utilize high regions of the atmosphere to take advantage of a less resistance of the air and of favorable high velocity winds.

MIGHT CHECK DEVELOPMENT

The factors which comprise "military performance" have therefore a high commercial value, and it is the opinion of this committee that any limitation

ARMAMENT CONFERENCE REPORT ON AIRCRAFT 201

of the character of civil and commercial aircraft must hinder the natural development of aviation, it is probable that restriction as to character will have in fact on even more adverse reaction on the progress of aviation than would be caused by a restriction on numbers.

8. METHOD OF LIMITATION.

Aircraft can be limited as to number and character by an agreement arbitrarily fixing a maximum number for each nation that will not be exceeded and by imposing technical restrictions in such a way as to limit performance.

9. The difference in organic law as between nations will probably prevent a single system of limitation being of universal application. Moreover, the rules of formulæ whereby alone the character of civil and commercial aircraft can be limited must be detailed and stringent. At the same time they will be easy to evade and infringement will not be obvious to the casual glance. Measurements of horse-power, supporting surface, fuel capacity and weight will be necessary if security against evasion is to be insured by any other means than by trusting to the good faith of the contracting parties. No state could consent to having the nationals of another power continually inspecting all of its manufacturing plants in order to ascertain whether the limitations it imposed were being enforced.

LOOPHOLES FOR INVASION

All these points received the closest of consideration with reference to the limitation of Germany's air power and the matter is so complicated that the final drafting of the technical rules has not yet been completed. But taking rules as drafted and even assuming continuous inspection of a most stringent character, it appears that there are still loopholes for evasion. No rules can prevent aircraft being designed in peace to permit of the ready installment of larger tanks in war; engines can be made interchangeable enabling one of higher power to be rapidly installed; even carrying surface can be increased by the standardization and interchangeability of wings and other methods and it is not impossible to conceive of civil and commercial aircraft being designed with a view to ultimate war requirements.

10. For the above reason the committee is agreed that in the present stage of development of aviation a universal limitation by formulæ of the character of commercial aircraft is impracticable.

QUESTION OF SUBSIDY

11. Without expressing an opinion as to the desirability of abolishing subsidies for the encouragement of commercial aviation the committee points out that such subsidies, direct or indirect, can have a great influence on the character and number of commercial aircraft in relation to their war value. In fact, subsidies will tend to decrease the natural divergence between military and commercial aircraft and render the latter more readily adaptable to war uses. It is necessary, however, to add that indirect subsidies or other encouragement are most difficult to prevent and even when acting in good faith governments of different nations will place different interpretations on such encouragement.

The question of whether subsidies are granted or not will have great bearing upon development of commercial aircraft in general, and will affect the future welfare of the nations. This question, therefore, can not be determined from the point of view solely of the adaptability for war uses.

CIVIL AIRCRAFT

In this discussion a distinction is drawn between commercial aircraft and civil aircraft. The latter will comprise all aircraft operated by a state except those which it operates in connection with its military enterprises. Civil aircraft will, therefore, include any which are state-operated in the customs service, for transporting the mails, the exercise of its police powers, and the like. It is readily apparent that as aircraft operate in a medium where there are no physical barriers, they can compete in some measure with every means of transportation used on land or water. It is therefore possible for much of the transportation requirements of any state to be met by the operation of aircraft. Such aircraft manifestly are not dependent for their being upon their ability to be operated at a profit. The state will decide how best it may enforce its laws, exercise its police power, transport state-owned merchandise or mails, and the means used will be those which are most efficient and most economical from the standpoint of the state itself. The cheapest will not always be the best, or the most satisfactory.

CIVIL CRAFT DEFY LIMIT

The number and the legitimate use of aircraft by any government for such civil purposes will, therefore, be limited only by the estimate placed upon the service which they can render and by the consent of the people to raising by taxation the amount of money which must be employed for their acquirement, operation and maintenance.

13. If the civil agencies of a state use aircraft for police or other purposes that are essentially military in character this class of civil aircraft should be discussed under the limitation of military aircraft.

14. The number and character of such civil aircraft can be limited only by an arbitrary agreement among the states.

15. It would, again, be utterly impracticable to set up any agency acting under authority other than that of a nation itself to regulate the number of civil aircraft owned and operated by the state.

LIGHTER-THAN-AIR CRAFT

LIMITATION OF NUMBER AND CHARACTER

16. The characteristics of lighter-than-air craft are such that limitation of number and character presents little technical or practical difficulty. It is a peculiarity of these craft that their efficiency is very intimately bound up in their size. Small dirigibles have a war value of their own, but it is limited and they can not be considered as offensive weapons. For example, a small vessel of this kind can not attain any considerable height while carrying a useful load, and even if filled with noninflammable gas its vulnerability to gun fire at the heights it could reach preclude its being utilized for such purposes as aerial bombardment. Only in large-sized dirigibles can a useful load be carried to a reasonable military height at a fair speed. Limitation of size is therefore sufficient to insure that lighter-than-air craft should be incapable of offensive aerial action. Moreover, the construction of large dirigibles requires large shed accommodation and can not be kept secret; in this respect they resemble surface warships.

ARMAMENT CONFERENCE REPORT ON AIRCRAFT 203

CAN CHECK DIRIGIBLES

17. It is therefore possible to regulate their numbers and size by a simple system of international agreement and infringement of such agreement can be readily detected without a detailed system of control.

18. The committee is agreed that the possibilities of war use for large dirigibles may still exist. Although in the later stages of the world war it appeared as if the defense had the mastery over attack in lighter-than-air craft, the introduction of larger craft filled with noninflammable gas and carrying their own protective aeroplanes may again permit bombardments being carried out by dirigibles.

This committee desires, however, to draw attention to the fact that dirigibles become increasingly efficient with increase of size. Any limit which is imposed on the size of commercial dirigibles must shut the door on the possibility of their development for legitimate civil enterprises.

LIMITATION OF THE USE OF AIRCRAFT

19. The committee is of the opinion that it would be useless to attempt to lay down a rule that civil and commercial aircraft should not be used in war, as they consider that no nation could deny itself the value for war purposes of their commercial machines provided that they are suitable for any warlike purposes. It is understood that when so used they will be manned by service personnel of the state and carry the proper distinguishing marks, and will in fact become war aircraft; their use does not therefore require discussion in this part of the committee report.

20. The use of civil and commercial aircraft in peace is governed by the international air convention which amply safeguards a state's sovereignty in the air against abuse.

SUGGESTS AIR CONVENTION

21. This convention has already been ratified by Great Britain, France, Japan, Belgium, Greece, Portugal, Serb, Croat and Slovene state and Siam. It will at a very near date come into force for these various powers and later for the other signatory states and also nonsignatory powers who desire to adhere to it.

22. The committee is aware, however, that for certain reasons the United States has not yet announced its adherence to this convention. The committee, therefore, suggests for the consideration of the subcommittee on program and procedure, that a convention covering the different phases of aerial navigation and based upon the one mentioned above could be drawn up at this conference to which the assent of all powers represented could be given. The committee further believe that this is most desirable.

SUMMARY OF CONCLUSIONS

CIVIL AND COMMERCIAL AIRCRAFT

23. This committee understands that the purpose of this conference is to promote peace and to remove the causes of warfare. It must be understood distinctly that if the conference decided to limit the development of commercial aircraft in order to retard the development of air power, the immediate

result will be the retarded development of means of transportation and communication which will itself, if unrestricted, largely act to bring about the same result, the removal of some of the causes of warfare.

24. This committee is unanimously of the opinion that in the present state of development of aeronautics there is a technical possibility of the limitation of numbers, character and use of civil and commercial aircraft with regard to their utilization in war; they are, however, agreed that such limitation of numbers and especially of character is not practicable, except in the case of lighter-than-air craft of above a certain displacement.

DECISION UP TO CONFERENCE

25. As regards the desirability of limitations, the committee has touched on those factors which must be understood before arriving at a decision. It feels it to be a duty to lay great stress upon the following fact which will have a decided bearing upon any determination of the proper policy to be adopted: Any limitation as to number and character of civil and commercial aircraft heavier-than-air or lighter-than-air, which is efficacious to hinder their utility for war purposes, must interfere disastrously with the natural development of aeronautics for legitimate civil and commercial enterprises. To limit the science of aeronautics in its present state is to shut the door on progress. It is for the conference to decide whether the limitations which can with difficulty be devised and imposed are to be adopted at such a cost.

MILITARY AIRCRAFT

Note—In the part of the report which follows the word "military" is used in its widest sense to denote "pertaining to the fighting services whether naval, military or air."

PRELIMINARY REMARKS

26. The committee agreed that before entering upon a discussion of possible limitation of the numbers of military aircraft, it was desirable that the present relative air strength of the nations represented should be ascertained and tabulated in a simple form designed to facilitate comparison between them. The results of this investigation are tabulated in appendices 1, 2, 3, 4, 5 attached to this report. It is remarked that though these forms afford a guide to the relative military air strengths at the present day, it is impracticable to present a complete estimate of a nation's air power, since air power is (as has been already shown) intimately bound up in factors other than the military establishment. Differences in organization and administration of the various national aerial forces are a further obstacle to direct comparison in detail; these factors must not be forgotten when studying the statement presented and must be kept in the foreground of all discussions as to the possibility of limitation.

AS TO NUMBER

27. The limitation of number of military aircraft presents from one point of view less difficulty than the similar problem in the case of commercial aircraft. It is obvious that if a limitation on the number of military aircraft is agreed upon between nations, it can be imposed by a state without that inter-

ARMAMENT CONFERENCE REPORT ON AIRCRAFT 205

ference with the liberty of citizens which complicates the question of aircraft devoted to commercial pursuits. But when the details of such an agreement are considered, it will be found a matter of great difficulty to find a reasonable basis on which the allotment of relative strengths can be made. For example:

(i) The "status quo" can not serve as a starting point, since the state of development of air services differs widely in the case of various powers (see appendices), and in no case can these services be considered as complete.

(ii) The size of a nation's navy and army will influence the basis, in so far as aircraft are essential auxiliaries to those services.

NATIONAL POLICIES DIFFER

(iii) National policy will differ as between nations; some nations, for example, will wish to have large air forces for coast defense where others prefer to trust to older methods. Development on the lines of the substitution of air forces for other forms of force are likely to be considerable.

(iv) The potentialities of air forces in policing and garrisoning semi-civilized or uncivilized countries are as yet only partially realized. The number of aircraft required for such duties will vary with the size and nature of the territories to be patrolled and with the value placed on their services by different nations.

MUST CONSIDER GEOGRAPHY

(v) The geographical position and peculiarities of a state, the situation and strength of its possible enemies, and the nature of a possible attack must influence the number of aircraft it will desire to maintain.

(vi) Different terms of service for personnel will influence the effectiveness of air services and the size of the reserve.

(vii) The state of development or possibilities for civil aeronautics will have, as has been shown above, a direct bearing on the number of military aircraft which it may be desirable for a state to maintain.

The problem of finding a suitable ratio between the air forces of various powers is thus at the present time almost insuperable.

AS TO CHARACTER

But even should it be possible to fix the ratio, such a limitation would be of little value without some limit as to the character of the aircraft. When the question of limitation of naval armaments was considered by the conference it was found necessary to limit the displacement of individual ships as well as the total tonnage. In the absence of similar provision the limitation of numbers of aircraft would only result in competitive building of aircraft of greater and greater power and size. The methods of limitation must, therefore, attempt to legislate for both number and character.

HEAVIER-THAN-AIR

METHODS OF LIMITATION

29. The following methods may be employed:

First. The limitation of the number of military aircraft.

Second. The limitation of the amount of horse-power for military aircraft.

Third. The limitation of the lift tonnage for military aircraft.

Fourth. The limitation of personnel for military aircraft.

Fifth. The limitation of military aircraft budgets.

These five methods may be applied in combination or singly and are considered in detail below:

Limitation of the number of aircraft is the most obvious method of limiting the strength of the aviation force, but in attempting to apply this method the question of size and type at once arises. It might be necessary to limit the maximum wing surface permitted to a single aircraft or it might be necessary to prescribe the number of aircraft in each of the type groups, such as combat planes, bombing planes, &c.; this question of definition of type presents great difficulty. In order to make an effective limitation of the numbers of military aircraft to be maintained in peace time by any nation, it will be necessary to have a detailed understanding on the following points:

PRESENTS GREAT DIFFICULTY

1. On the number and types actually in use by organized aerial units.
2. On the number and types held in reserve.
3. On the number and type of engines held in reserve.
4. On the replacement of planes crashed, worn out, or replaced by later models. In the case of obsolete and other planes that are replaced by other models it would be necessary to enter into an agreement regarding the disposal of planes so replaced. Otherwise it would be possible to build up an unlimited war reserve merely by classifying the planes so held as obsolete, or by converting them into civil or commercial planes.
5. On the limitation of the adoption of new and more powerful types.

All these points will present great difficulty in an age when aircraft can become obsolete in a few months, and when their nature is such that war wastage may be as high as 200% per month.

SECOND METHOD OUTLINED

The second method of limitation, limitation of horse-power may apply to:

- (1) Total horse-power in assembled planes.
- (2) Total horse-power in assembled engines.
- (3) Horsepower in a single individual plane of a given type.

This can only be based on the cubic capacity of the engines; there will be no guarantee that a nation has not discovered a secret which will enable greater horse-power to be got out of limited capacity, nor is it reasonable to expect any nation to disclose such a secret. The more detailed the limitation the greater the administrative difficulty of enforcement, particularly under present conditions, when administrative methods are so widely different, and, as pointed out in the first part of the report, any enforcement, to be effectual, would entail such detailed inspection by a foreign commission as to be intolerable to any nation.

LIFT TONNAGE PLAN

The third method of limitation, limitation of lift tonnage, may apply to:

- (1) Total lift tonnage in assembled planes.
- (2) Total lift tonnage in all planes assembled or not assembled.
- (3) Lift tonnage of a single individual plane of a given type.

ARMAMENT CONFERENCE REPORT ON AIRCRAFT 207

Any method must presumably be based on wing area and horse-power. It has been mentioned that the actual horse-power may be unknown, and it is conceivable that a nation may discover a wing shape of extreme lifting efficiency and neglect to disclose the fact. Limitation of lift tonnage may therefore be wholly illusory, and the remarks as to inspection made in the last paragraph apply to this method also.

POINT OUT DIFFICULTIES

33. The fourth method of limitation, whether of the total of organized personnel for war aircraft or only of pilots in the permanent military establishment, fails by reason of the difference in organization between different states. A nation which has a separate air service has to include in its organized personnel those employed in recruiting, supply, transport, administrative headquarters, &c. In the case of nations whose air forces are contained in their naval and military forces, supply, &c., personnel are included in naval and military establishments; a fair comparison can not therefore be made. Moreover the difference in terms of service, long or short, voluntary service or conscription, must introduce incalculable factors which directly affect the efficiency of organized air forces and the size and efficiency of the reserve.

FEAR TO CAUSE FRICTION

34. The fifth method of limitation, limitation by means of limiting the budget and thereby controlling the amount of money that may be expended annually for aviation, seems simple in theory, but it is difficult of application. The various methods of distributing budgets for material under different subheads make it impracticable to determine or compare the actual sums expended exclusively for aircraft, and the question is at present further complicated by the factor of the relative purchasing power of the currency of various nations.

35. Of the five methods of limitation, limitation by lift tonnage or horse-power appears to present the least objections, but to make these or any other methods effective, it would be necessary (as previously pointed out) to organize a system of international inspections. Any system of international inspection would be almost certain to arouse ill feeling and would tend to cause friction rather than to insure harmony and good feeling between friendly powers.

IMPRACTICABILITY OF LIMITATION OF NUMBER AND CHARACTER

36. Objections in detail to each suggested method of limitation have been advanced above—there is one insuperable objection which is common to every method, namely, the close relationship which at present exists between civil or commercial aeronautics and air power. Unless civil and commercial aeronautics are strictly limited—and it has been shown in the early part of this report that it is not practicable to limit them—a nation desiring air power in excess of the limit imposed or agreed to will develop its civil and commercial aeronautics to any extent desired.

Granted a flourishing aeronautical industry, the number of the present type of perishable military aeroplanes active on any given date is only one of the elements of air power. During the war a single American firm contracted to deliver 100 aircraft a day, and the output of engines can be organized on a similar scale. A nation's air power can thus be multiplied not only

by the actual number of civil and commercial aircraft in use, but also by the capacity of the industry to turn to the manufacture of military aircraft in large quantities. Limitation of the number of horse-power and lift tonnage would under such conditions prove illusory. This commercial industry will further provide a great potential reserve of pilots and skilled technical personnel and will thus discount to a great extent any limitation of numbers of the personnel of military aviation.

BELIEVE LIMIT IMPRACTICABLE

37. It is the opinion of this committee that the limitation of military air power (as regards heavier-than-air craft) is not practicable at the present time. Their reasons for this decision are as follows:

(I) The difficulty of finding a basis for the proportion of aircraft to be allotted to the various nations.

(II) The difficulty of devising technical methods to impose such limitation.

(III) The difficulty of enforcing such methods.

(IV) The interdependence between air power and a commercial aircraft industry which it is not practicable to limit.

LIGHTER-THAN-AIR CRAFT

38. Many of the remarks already made apply to lighter-than-air craft, but, as in the case of commercial aircraft of this nature, limitation is both possible and practicable. It is unnecessary to recapitulate the argument that the military value of a dirigible is dependent on its size, and the size of dirigibles and the number maintained can be limited by agreement of a few simple rules. Infraction of such rules can be rapidly ascertained without detailed inspection. But such a limitation of lighter-than-air aviation forces would not effect a limitation of this kind of air power of a nation unless a limitation were also imposed on its lighter-than-air commercial activities. The line of demarkation between the large commercial airship and the military airship is very slight, and a commercial dirigible would require little, if any, alteration in order to adapt it to military purposes. The objections to the limitation of the number or character of commercial lighter-than-air craft have already been remarked on.

THE QUESTION OF THE USE OF MILITARY AIRCRAFT

39. It is necessary in the interests of humanity and to lessen the chances of international friction that the rules which should govern the use of aircraft in war should be codified and be made the subject of international agreement.

40. The matter has been considered by this committee in connection with a draft code of "Rules for aircraft in war," submitted for remarks by the committee on the laws of war. The subject appears to the committee to be one of extreme importance and one which raises far-reaching problems, legal, political, commercial and military; it requires therefore exhaustive discussion by a single committee in which experts on all these issues are assembled.

The representatives of the United States and Japan on this committee are prepared to discuss the rules submitted from a technical point of view as provided for in the agenda under paragraph on limitation of new types of

ARMAMENT CONFERENCE REPORT ON AIRCRAFT 209

military arms, but the representatives of Great Britain, France and Italy are not so prepared. They state that the time between receipt of the agenda for the conference and their date of sailing has not permitted that exhaustive discussion of the subject that would enable them to advance a national viewpoint on a matter which affects so many and varied interests. In some cases the national policy has not yet been determined.

FOR FURTHER CONFERENCE

41. This committee recommends, therefore, that the question of the rules for aircraft in war be not considered at a conference in which all the members are not prepared to discuss so large a subject, but that the matter be postponed to a further conference which it is recommended be assembled for the purpose at a date and place agreed through diplomatic channels.

SUMMARY OF CONCLUSIONS ARRIVED AT BY THE COMMITTEE ON NUMBER, CHARACTER, AND USE OF AIRCRAFT

42. The committee are agreed that among the more important elements which influence the power that a nation may exert by means of aircraft are the following:

- (1) The adaptability of its people to aeronautics.
- (2) Geographic location and characteristics of the territory occupied by the nation and its dependencies.
- (3) The ability to produce and maintain aircraft and accessories.
- (4) The amount and character of aeronautical activity outside the military establishment, such as commercial and civil aeronautical activities, and sport and pleasure flying.
- (5) The size and efficiency of its air establishment for military purposes consisting of (a) the active establishment including permanent headquarters, bureaus, squadrons, schools, technical establishments, depots of material and personnel, &c., (b) the reserve establishment including organized and unorganized reserve personnel and war reserve of material.

ADAPTABILITY IS VARIED

43. (1) The adaptability of a nation to aeronautics.

Interest of the general public in aeronautics seems to be inherent in some nations; in others it is dormant or almost lacking. The confidence of a people in aeronautics in general is undoubtedly a factor worthy of serious consideration when estimating the air power of that country. It is possible that a far-seeing government may stimulate the interest of its general public in aeronautics by exhibitions, general educational measures, and by the encouragement in a financial way of individuals already interested, and thus increase the adaptability of its people to aeronautics.

44. (2) Geographic location and characteristics of the territory occupied by the nation and its dependencies.

This may be looked on as closely akin to (1). The physical characteristics of a country will have a considerable influence on the attitude taken by its inhabitants toward aviation. It is obvious that, while the government action may improve the natural characteristics of a country to a certain degree, by making aerodomes, &c., it is not possible for any limitation of such action to be made except by limiting the total amount spent by the nation on aviation, a method which has already been shown to be largely ineffective.

MANY FACTORS INVOLVED

45. (3) The ability to produce and maintain aircraft and accessories.

The maximum aeronautical industry possible for a nation to build up under ideal conditions is determined by (1) the extent to which manufacturing in general is carried on; (2) by the character of articles manufactured; (3) by the manufacturing methods in general, that is, whether articles are manufactured by machinery or by hand; (4) the supply and availability of essential raw materials. In the manufacture of many articles the raw materials used and the manufacturing methods are similar to those employed in the manufacture of aircraft and accessories. The amount of this class of manufacturing carried on in any country is an essential factor in estimating the ability of a nation to produce aircraft.

LIST ELEMENTS OF AIR POWER

The ability to expand an existing aeronautical industry rapidly enough to meet war conditions is one of the most important elements of air power. This may be estimated by (1) the number of individuals skilled in the manufacture of aircraft and accessories; (2) the number of individuals whose training in industries similar to the aeronautical industry forms a basis for learning readily and rapidly the special problems encountered in the manufacture of aircraft and accessories; (3) the size and condition of the existing aeronautical industries and the size and number of manufacturing concerns that can readily be converted to the manufacture of aircraft and accessories; (4) the existence of a definite program previously determined upon, and the extent to which orders have been previously placed in anticipation of an emergency, with a consequent perfection of plans; (5) the amount and state of availability of the essential raw materials; (6) the quantity of available jigs, tools, dies and production drawings for going into quantity production of standard equipment.

INDUSTRY FORMS RESERVE

46. (4) The amount and character of aeronautical activity outside the military establishment has been exhaustively discussed under the limitation of Civil and commercial aircraft. It has been shown that this is intimately bound up with (1), (2) and (3) above, and that, with the exception of lighter-than-air craft of above a certain size, it is not practicable to limit it except perhaps by limiting the amount of subsidies to commercial aviation, a method which has been shown to be difficult of application and to be otherwise objectionable. It has also been shown that the limitation of lighter-than-air craft would have a disastrous effect on aviation.

47. (5) Existing establishment of aircraft used for military purposes and the reserve.

The size of the organized reserve will depend upon the size of the military establishment and the rate at which members of the military establishment are trained and returned to civil pursuits. Any reduction in the permanent peace-time establishment will carry with it a consequent reduction in organized and trained reserves. There is, however, a type of personnel whose civil pursuits fit them for immediate service in the air establishment. This class is made up by those engaged in commercial and civil aeronautics and industrial pursuits which require the same trades and basic knowledge and experi-

ARMAMENT CONFERENCE REPORT ON AIRCRAFT 211

ence as is required in the operation and maintenance of military aircraft. This class will not be seriously affected by any change in the military establishment.

RESULTS OF LIMITATION

48. Technical considerations have led the committee to the conclusion that the limitation of the fifth element, namely, the size and efficiency of peace-time air establishments for military purposes (including the active establishment and the organized reserve), although theoretically possible, is not practicable. The committee also desires to lay stress on the fact that, even if such limitation was practicable, it would not prevent the use of air power in war, but would only operate to give greater comparative importance to the other elements of air power which cannot be limited for the reasons given in the report.

FINAL CONCLUSION

NUMBER AND CHARACTER

The committee is of the opinion that it is not practicable to impose any effective limitations upon the numbers or characteristics of aircraft, either commercial or military, excepting in the single case of lighter-than-aircraft.

USE

The committee is of the opinion that the use of aircraft in war should be governed by the rules of warfare as adapted to aircraft by a further conference which should be held at a later date.

Respectfully submitted by

COMMITTEE ON AIRCRAFT.

For the United States of America—William A. Moffett, chairman, rear admiral, U. S. N.; Mason M. Patrick, major general, U. S. A.

For the British Empire—J. F. A. Higgins, air vice marshal, R. A. F.

For France—Albert Roper, capitaine pilote aviateur, French army.

For Italy—Riccardo Moizo, colonel, R. I. A.

For Japan—Osami Nagano, captain, I. J. N.

Note: The Italian representative believes and desires to place on record that one way in which it would be possible to limit the air power of a nation would be by placing a limit upon the number of pilots in the permanent military establishment and consequently agrees with the general reasoning of the report in so far as it is not contrary to this opinion.

(Signed)

COL. R. MOIZO.

(Riccardo Moizo, Colonel, R. I. A.)

Washington, D. C., Jan. 7, 1922.

AIR MAIL SERVICE, POST OFFICE DEPARTMENT

EXECUTIVES

Col. Paul HendersonSecond Assistant Postmaster General
C. F. EggeGeneral Superintendent
C. I. StantonAssistant General Superintendent
James C. EdgertonSuperintendent of Radio
G. L. ConnerChief Clerk

DIVISION SUPERINTENDENTS, ETC.

J. E. Whitbeck, Eastern Division, Hazelhurst Field, Hempstead, L. I., N. Y.
A. R. Dunphy, Central Division, Omaha, Nebraska.
G. H. Colwell, Western Division, San Francisco, California.
E. J. Scanlon, Warehouse, 115 Gotthardt St., Newark, N. J.
Randolph G. Page, Repair Depot, Maywood, Ill.

AIR MAIL FIELDS

(For description of fields and hangars see Year Book, 1921, p. 222.)

College Park, Md. (Headquarters)	*North Platte, Nebr.
*Hazelhurst Field, Hempstead, L. I., N. Y.	*Cheyenne, Wyo.
*Bellefonte, Pa.	Rawlins, Wyo.
*Cleveland, Ohio.	*Rock Springs, Wyo.
*Bryan, Ohio.	*Salt Lake City, Utah.
*Chicago, Ill. (Checkerboard Field, Maywood, Ill.)	*Elko, Nev.
*Iowa City, Ia.	*Reno, Nev.
*Omaha, Nebr.	*San Francisco, Cal.

TRANSCONTINENTAL CONTROLS

Hazelhurst Field, L. I., N. Y.—
Bellefonte, Pa. 225 miles
Cleveland, Ohio 210 miles
Bryan, Ohio 160 miles
Chicago, Ill. 175 miles
Iowa City, Ia. 195 miles

* Denotes a radio station.

AIR MAIL SERVICE

213

Omaha, Nebr.	230 miles
North Platte, Nebr.	245 miles
Cheyenne, Wyo.	215 miles
Rawlins, Wyo.	134 miles
Rock Springs, Wyo.	106 miles
Salt Lake City, Utah	155 miles
Elko, Nev.	205 miles
Reno, Nev.	235 miles
San Francisco, Cal.	190 miles

Total	2680 miles
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Above distances went into effect October 1, 1921.

PLANES IN SERVICE

<i>Type</i>	<i>Engine</i>	<i>Horse- Power</i>	<i>Mail Capacity</i>	<i>Number in Service</i>
Remodeled DeHaviland-4's	Liberty-12	400	550 lbs.	80

AIR MAIL SERVICE Consolidated Statement of Performance from May 15, 1918, to Dec. 31, 1921

Month	Trips Possible (Scheduled)	Trips Attempted	Trips Deferred	Trips Uncompleted	Weather Encountered		Mileage Possible (Scheduled)	Miles Travelled with Mail	Miles Ferry and Test	Total Miles Travelled	Per cent of performance	Mail Carried (lbs.)	Cost of Service	Forced Landings due to	
					Trips in Fog, etc.	Trips Clear								Mechanical	Other Causes
1918															
May, 15 days.....	60	53	7	....	31	29	6,750	5,324	1,910	7,234	78.87	4,750	\$3,682.11	2	2
June.....	100	96	4	....	35	65	11,250	10,685	3,470	14,155	94.27	13,081	9,922.71	4	4
July.....	108	106	2	....	41	67	12,150	11,855	2,746	14,601	97.37	16,967	10,001.46	4	4
August.....	109	109	0	....	17	92	11,988	11,984	3,136	15,120	99.96	16,588	9,535.67	1	1
September.....	100	100	0	....	36	64	10,900	10,900	4,363	15,263	100.00	15,200	9,638.74	2	0
October.....	108	108	0	....	24	84	11,772	11,617	1,054	12,671	98.68	16,788	9,841.76	2	0
November.....	104	102	2	....	24	80	11,336	11,118	2,571	13,689	98.07	16,854	10,673.68	0	1
December.....	104	91	13	....	50	54	10,896	8,415	1,400	9,815	77.23	17,778	13,300.46	7	11
1919															
January.....	108	92	16	....	53	55	11,772	9,653	1,485	11,138	82.00	18,105	13,741.58	1	5
February.....	97	92	5	....	42	55	10,554	9,307	1,675	10,982	88.18	15,489	13,645.16	6	8
March.....	106	102	4	....	34	70	11,654	10,699	136	10,835	92.59	17,531	13,880.29	5	5
April.....	107	105	2	....	32	75	11,682	11,105	392	11,497	95.06	16,677	13,516.44	2	7
May.....	146	143	3	....	62	81	23,296	22,578	819	23,397	96.92	26,626½	17,715.66	4	9
June.....	160	160	0	....	46	114	30,943	30,835	15,143	45,978	99.65	35,647	30,891.62	4	4
July.....	178	173	5	....	59	115	58,909	56,577	15,143	62,175	96.04	48,704	41,134.36	7	5
August.....	176	174	2	....	59	115	58,946	58,022	11,073	69,095	98.43	56,870	40,614.59	3	6
September.....	172	171½	½	....	40½	131	57,103	56,308	8,428	64,736	98.60	55,668	34,861.53	5	6
October.....	178	165	14	....	63	101	58,582	50,437	9,093	59,530	86.27	55,095	35,609.03	11	19
November.....	177	172	11½	....	54½	82	48,214	41,757	8,848	50,605	86.61	54,084	31,127.58	6	14
December.....	156	125½	30½	....	58½	67	48,620	35,788	5,539	41,327	73.61	41,246	33,909.86	16	9
1920															
January.....	156	123½	46 (13½ extrn.)	....	39½	84	48,620	33,952	6,506	40,458	69.83	43,125	52,551.66	16	10
February.....	146	113½	32½	....	48	65½	45,970	32,647	5,511	38,158	71.02	37,242	46,004.12	4	1
March.....	210	169	41	....	38	131	49,010	37,861	9,129	46,990	77.25	42,361	44,785.71	12	8
April.....	208	180	28	9	85	95	48,620	41,890	47,881	47,881	86.16	42,066	55,343.40	28	7
May.....	232	211	21	7	78	133	59,670	54,138	10,844	64,982	90.72	51,112	57,004.83	11	11
June.....	260	204	56	17	74	130	71,500	54,367	12,596	62,463	69.74	59,005	80,209.43	29	9
July.....	260	253	7	17	40	213	71,500	69,140	4,862	74,002	96.69	68,401	85,993.59	25	14
August.....	368	347	21	19	55	292	79,502	73,456	42,567	116,023	92.42	73,140	73,026.93	39	29
September.....	696	502	194	57	300	112	143,322	105,847	26,355	132,202	73.84	91,150	108,751.76	47	30
October.....	750	593	157	30	390	403	154,700	123,274	31,212	154,486	79.68	89,541½	123,618.68	54	59
November.....	758	575	183	77	230	345	156,076	114,750	25,009	139,759	73.50	87,302	121,501.18	85	69
December.....	884	662	222	105	347	315	178,776	127,306	3,734	131,040	71.21	89,942	131,205.96	89	138

AIR MAIL SERVICE — Continued

Month	Trips Possible (Sched- uled)	Trips At- tempted	Trips De- ficient	Trips Uncom- pleted	Weather En- sidered		Mileage Possible (Sched- uled)	Miles Traveled with Mail	Miles Ferry and Test	Total Miles Traveled	Per cent of per- forma- nce	Mail Carried (lbs.)	Cost of Service	Percent Load- ing due to	
					Trips in Fog, etc.	Trips Clear								Me- chan- ical	Other Causes
1921															
January.....	850	697	153	87	253	444	171,900	132,679	6,930	139,609	77.18	84,435	\$ 136,488.61	117	131
February.....	782	660	122	71	310	350	159,238	130,431	13,224	143,655	81.90	88,135	131,855.43	122	123
March.....	918	871	47	59	351	520	185,652	171,593	15,032	186,625	92.42	110,117	152,442.27	84	123
April.....	884	837	47	36	370	467	178,776	171,156	15,794	186,950	95.73	117,778	147,890.64	70	107
May.....	850	833	17	20	320	513	171,900	168,397	12,819	181,216	97.96	115,073	125,754.74	72	81
June.....	832	829	3	10	268	561	168,636	166,956	18,155	185,091	99.00	105,838	127,479.83	57	51
July.....	624	623	1	6	65	538	131,450	130,555	18,129	148,684	99.31	77,276	109,799.11	34	29
August.....	624	623	1	13	129	560	135,974	134,549	14,883	149,432	98.72	84,690	106,986.98	35	30
September.....	693	689	4	18	180	471	127,706	125,914	22,185	148,099	98.59	88,401	102,998.45	13	26
October.....	714	707	7	8	166	541	140,080	138,759	20,212	158,971	99.05	96,057	122,408.81	23	21
November.....	672	633	39	46	285	348	131,520	117,529	25,616	143,145	89.36	93,519	117,417.83	17	74
December.....	726	660	66	37	266	394	132,240	125,416	15,840	141,256	88.17	101,198	116,268.70	42	46
TOTALS.....	16,684	15,076	1,642	728	5,439	9,640†	3,470,655	3,083,026	471,994	3,525,020	87.96	2,499,643	\$2,876,845.64	1,168	1,374

* Cleveland-Chicago route inaugurated May 15, 1919.

† New York-Cleveland service inaugurated July 1, 1919.

‡ New York-Cleveland service on New York-Cleveland and Cleveland-Chicago routes discontinued.

§ November 9th, Sunday service on New York-Cleveland and Cleveland-Chicago routes discontinued.

|| Transcontinental service inaugurated September 8, 1920.

¶ May 31, 1921, — Last Day's service on New York-Washington route.

§§ June 30, 1921, — Last Day's service on St. Louis-Twin Cities Division.

§§§ Temporary service from Elko to Ely, Nevada, inaugurated October 19th.

§§§§ Washington to New York, prior to July reported as two trips on account of exchange of mails at Philadelphia, and subsequent to that date non-stop flights reported as one trip.

†† Flight New York to Cleveland considered two trips (i.e. New York-Bellefonte and Bellefonte-Cleveland) from March 1, 1920.

AIR MAIL SERVICE
Consolidated Statement of Performance from May 15, 1918, to Dec. 31, 1921

Month	Trips Possible (Scheduled)	Trips Attempted	Trips Disrupted	Trips Uncompleted	Weather Encountered		Mileage Possible (Scheduled)	Miles Traveled with Mail	Miles Ferry and Test	Total Miles Traveled	Per cent of performance	Mail Carried (lbs.)	Cost of Service	Forced Landings due to	
					Trips in Fog, etc.	Trips Clear								Mechanical	Other Causes
1918															
May, 15 days.....	60	53	7	....	31	29	6,750	5,324	1,910	7,234	78.87	4,750	\$3,682.11	2	2
June.....	108	96	2	....	35	65	11,250	10,685	3,470	14,155	94.97	16,967	9,922.71	4	4
July.....	108	106	2	....	41	67	12,150	11,835	2,746	14,601	97.37	15,967	10,001.46	4	4
August.....	109	109	0	....	17	92	11,988	11,988	3,136	15,120	99.96	16,588	9,535.67	1	1
September.....	100	100	0	....	36	64	10,900	10,900	4,363	15,263	100.00	15,200	9,638.74	1	1
October.....	108	108	0	....	24	84	11,772	11,617	1,054	12,671	98.68	16,788	9,841.76	2	0
November.....	104	102	2	....	24	80	11,336	11,118	2,571	13,689	98.07	16,854	10,673.68	0	1
December.....	104	91	13	....	50	54	10,896	8,415	1,400	9,815	77.23	17,778	13,300.46	7	11
1919															
January.....	108	92	16	....	53	55	11,772	9,653	1,485	11,138	82.00	18,105	13,741.58	1	5
February.....	97	92	5	....	42	55	10,554	9,307	1,675	10,982	88.18	15,489	13,645.16	6	8
March.....	106	102	4	....	34	70	11,654	10,699	136	10,835	92.59	17,531	13,880.29	5	5
April.....	107	105	2	....	32	75	11,682	11,105	392	11,497	95.06	16,677	13,516.44	2	2
May.....	146	143	3	....	62	81	23,296	22,578	819	23,397	96.92	26,626½	17,715.66	3	9
June.....	160	160	0	....	46	114	30,943	30,835	15,143	45,978	99.65	35,647	30,891.62	4	4
July.....	178	173	5	....	59	114	58,909	56,577	5,598	62,175	96.04	48,704	41,134.36	7	5
August.....	176	174	2	....	59	115	58,946	58,022	11,073	69,095	98.43	56,870	40,614.59	3	6
September.....	172	171½	½	....	63	131	57,103	56,308	8,428	64,736	98.60	55,668	34,861.53	5	6
October.....	178	165	14	....	54½	82	58,582	50,437	9,093	59,530	86.27	55,095	35,609.03	11	19
November.....	177	125½	11½	54½	82	48,214	41,757	8,848	50,605	86.61	54,084	31,127.58	6	14
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1920															
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February.....	146	113½	32½	48	65½	45,970	32,647	5,511	38,158	71.02	37,242	46,004.12	4	1
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April.....	208	180	28	9	85	95	48,620	41,890	5,991	47,881	86.16	42,066	55,343.40	28	7
May.....	232	211	21	78	133	59,670	54,138	10,844	64,982	90.72	51,112	57,004.83	17	11
June.....	260	204	56	17	74	130	71,500	49,867	12,596	62,463	69.74	59,005	80,209.43	29	9
July.....	260	253	7	....	40	213	71,500	69,140	4,862	74,002	96.69	68,401	85,993.59	25	14
August.....	368	347	21	19	55	292	79,502	73,456	42,567	116,023	92.42	73,140	73,026.93	39	29
September.....	696	502	194	30	390	112	143,322	105,847	26,355	132,022	73.84	91,150	108,751.76	47	30
October.....	750	593	157	57	390	103	154,322	123,274	31,212	154,486	79.68	89,541½	123,618.68	54	59
November.....	758	575	183	77	230	345	156,076	114,750	25,009	139,759	73.50	87,302	121,501.18	85	69
December.....	884	662	222	105	347	315	178,776	127,306	3,734	131,040	71.21	89,942	131,205.96	89	138

AIR MAIL SERVICE — Continued

Month	Trips Possible (Scheduled)	Trips Attempted	Trips Deferred	Trips Uncompleted	Weather Encountered		Miles Possible (Scheduled)	Miles Traveled with Mail	Miles Ferry and Test	Total Miles Traveled	Per cent of Performance	Mail Carried (lbs.)	Cost of Service	Forced Landings due to	
					Trips in Fog, etc.	Trips Clear								Mechanical	Other Causes
1921															
January.....	850	697	153	87	253	444	171,900	132,679	6,930	139,609	77.18	84,435	\$ 136,488.61	117	131
February.....	782	660	122	71	310	320	159,238	130,431	13,224	143,655	81.90	88,135	131,855.43	82	123
March.....	918	871	47	59	351	520	185,652	171,593	15,032	186,625	92.42	110,117	152,442.27	64	123
April.....	884	837	47	36	370	467	178,776	171,156	15,794	186,950	95.73	117,778	147,890.64	79	107
May.....	850	833	17	20	320	513	171,900	168,397	12,819	181,216	97.96	115,073	125,754.74	72	81
June.....	832	829	3	10	268	561	168,636	166,956	18,155	185,091	99.00	105,838	127,479.83	57	51
July.....	624	623	1	6	65	558	131,455	130,535	18,129	148,664	99.31	77,276	109,799.11	34	29
August.....	693	689	4	13	129	560	136,974	134,549	14,883	149,432	98.22	84,680	106,986.98	32	30
September.....	657	651	6	8	180	471	127,706	125,914	22,185	148,099	98.59	88,401	102,998.45	13	26
October.....	714	707	7	7	166	541	140,080	138,759	20,212	158,971	99.05	99,057	122,205.51	23	21
November.....	672	633	39	46	285	348	131,520	117,529	25,616	143,145	89.36	93,519	117,417.83	17	74
December.....	726	660	66	37	266	394	142,240	125,416	15,840	141,256	88.17	101,198	118,264.70	42	46
TOTALS.....	16,684	15,076	1,642	728	5,439	9,640	3,470,655	3,053,026	471,994	3,525,020	87.96	2,499,643	\$2,876,945.64	1,168	1,374

*Cleveland-Chicago route inaugurated May 15, 1919.

**New York-Cleveland service inaugurated July 1, 1919.

***November 9th, Sunday service on New York-Cleveland and Cleveland-Chicago routes discontinued.

****Transcontinental service inaugurated September 8, 1920.

*****May 31, 1921.—Last Day's service on New York-Washington route.

*****June 30, 1921.—Last Day's service on St. Louis-Twin Cities Division.

*****Temporary service from Elko to Ely, Nevada, inaugurated October 19th.

†Flight Washington to New York, prior to July reported as two trips on account exchange of mails at Philadelphia, and subsequent to that date non-stop flights reported as one trip.

††Flight New York to Cleveland considered two trips (i.e. New York-Bellefonte and Bellefonte-Cleveland) from March 1, 1920.

FOREST FIRE PATROL

(Department of Agriculture)

Season 1921

	District No. 5 California	District No. 6 Oregon and Washington	Totals
Total No. of fires reported	595	653	1248
No. of fires inside of Natl. Forests.....	277	107	384
No. of fires outside of Natl. Forests.....	338	546	884
No. of fires reported first by air patrol..	207	166	373
No. of fires reported by other agencies..	292	112	404
Unconfirmed fires	96	320	416
False fires (logging camps, permits, etc.)	...	55	55
No. of fires reported by radio	209	482	691
No. of fires reported on landing	48	171	219
Communication efficiency .....	...	67.39 per cent	...
Accuracy of location .....	...	91.13 per cent	...

NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS

2722 Navy Building, Washington, D. C.

ORGANIZATION

Charles D. Walcott, Sc.D., Chairman	
S. W. Stratton, Sc.D., Secretary	
Joseph S. Ames, Ph.D., Chairman, Executive Committee	
Major Thurman H. Bane, U.S.A.	Charles F. Marvin, M.E.
Rear Admiral W. A. Moffett, U.S.N.	Maj. Gen. M. M. Patrick, U.S.A.
William F. Durand, Ph.D.	Michael I. Pupin, Ph.D.
John F. Hayford, C.E.	Rear Admiral D. W. Taylor, U.S.N.
Orville Wright, B. S.	
Executive Officer, G. W. Lewis	
Assistant Secretary, J. F. Victory	

The National Advisory Committee for Aeronautics is the official agency of the Government for determining the problems of flight involving applied scientific research. In addition to the exercise of its function of supervising and directing the scientific study of the problems of flight as required by law, the Committee also serves as an advisory committee for the consideration of questions of general aeronautical policy. In its last annual report to Congress, the Committee made a number of recommendations which may be summarized as follows:

The most urgent need for the successful development of aviation at the present time, either for military or civil purposes, is the enactment of legislation providing for the Federal regulation of air navigation, including the licensing of aviators, aircraft, airways and airdromes; the airways should consist of chains of landing fields providing supply and repair facilities and including the necessary meteorological stations, observations, and reports. If the Federal Government will establish and regulate transcontinental airways, as recommended, the committee is confident that air lines for the transportation of passengers or goods will be rapidly established by private enterprises in all parts of the country.

The committee emphasizes the importance of extending aerological service (under the Weather Bureau) along airways as established, and recommends that adequate provision of law be made for this service, which is so indispensable to the success and safety of air navigation.

Whatever may have been the faults or the shortcomings of the aircraft industry during or since the war, the fact remains that there must be an aircraft industry, and that it should be kept in such a condition as to be able to expand promptly and properly to meet increased demand in case of emergency. The Government, as the principal consumer, is directly con-

cerned in the matter, and should formulate a policy which would be effective to sustain and stabilize the aeronautical industry and encourage the development of new and improved types of aircraft.

Aviation is indispensable to the Army and to the Navy in warfare; and its relative importance will continue to increase. Other branches of the military services are comparatively well developed, whereas aviation is still in the early stages of its development. The demand for greatly reduced expenditures in the military and naval services should not apply to the air services. The committee recommends that liberal provision be made for the Army and Navy Air Services, not only that provision be made for the maintenance and training of personnel, but also that the funds be adequate to insure the fullest development of aviation for military and naval purposes.

Substantial progress in aeronautical development, whether for military or commercial purposes, must be based upon the applications to the problems of flight of scientific principles and the results of research. The exact prescribed function of the National Advisory Committee for Aeronautics is the prosecution and coordination of scientific research, and, while encouragement may be taken from the progress made, greater provision for the continuous prosecution of research on a larger scale is strongly recommended by the committee.

The Air Mail Service has demonstrated that airplanes can be utilized with certain advantages in carrying the mails, despite the handicap of using military types of aircraft, poorly adapted to its work or to any civil or commercial purpose. There are several causes which are delaying the development of civil aviation, such as the lack of airways, landing fields, aerological service, and aircraft properly designed for commercial uses. The Air Mail Service stands out as a pioneer agency, overcoming these handicaps and blazing the way, so to speak, for the practical development of commercial aviation. As a permanent proposition, however, the Post Office Department, as its functions are now conceived, should no more operate directly a special air mail service than it should operate a special railroad mail service; but until such time as the necessary aids to commercial aviation have been established it will be next to impossible for any private corporation to operate under contract an air mail service in competition with the railroads. The National Advisory Committee for Aeronautics therefore recommends that provision be made for the continuation of the Air Mail Service under the Post Office Department.

The United States has a virtual monopoly of the known sources of supply of helium, and these are limited. Experiments have been conducted by the Bureau of Mines with a view to the development of methods of production and storage, but as yet the problem of storage in large quantities has not been satisfactorily solved. Because the known supply is limited, because it is escaping into the atmosphere at an estimated rate sufficient to fill four large airships weekly, and because of the tremendously increased value and safety which the use of helium would give to airships, particularly in warfare, it is, in the opinion of the National Advisory Committee for Aeronautics, the very essence of wisdom and prudence to provide for the conservation of large reserves through the acquisition and sealing by the Government of the best helium-producing fields. Attention now being given to the development of types of airships to realize fully the advantages which the use of helium would afford should be continued. Such development would give America advantages, for purposes either of war or commerce, with which no other nation could successfully compete.

In transmitting the annual report of the Committee, President Harding endorsed its recommendations in the following letter:

"To the Congress of the United States:

"In compliance with the provisions of the act of March 3, 1915, establishing the National Advisory Committee for Aeronautics, I transmit herewith the seventh annual report of the committee for the fiscal year ended June 30, 1921.

"I think there can be no doubt that the development of aviation will become of great importance for the purposes of commerce, as well as for national defense. While the material progress in aircraft has been remarkable, the use has not yet been extensively developed in America. This has been due, in the main, to lack of wise and necessary legislation. Aviation is destined to make great strides, and I believe that America, its birthplace, can and should be foremost in its development.

"I therefore urge upon the Congress the advisability of giving heed to the recommendations of the committee, the first and most important of which is that a bureau be established in the Department of Commerce for the regulation and development of air navigation.

WARREN G. HARDING."

"The White House,

"December 7, 1921."

CUSTOMS REGULATIONS

(Treasury Department)

At this time there are no custom laws on the statute books relating particularly to aircraft, and importations of and by aircraft are governed by the laws and regulations relating to other merchandise and vehicular traffic. Under the provisions of Paragraph O, Section IV of the Tariff Act of October 3, 1913, aircraft and aircraft parts manufactured or produced with the use of imported duty-paid materials and exported are entitled to a drawback or refund of 99 per cent of the duties paid on the imported materials used, and that a number of manufacturers of such articles have been granted rates of drawback on the same.

Airplanes, airships and balloons, imported for the purpose of taking part in races or other contests, may be entered under bond for their exportation within three months after importation, in the same manner as automobiles imported for similar purposes are admitted under bond, in accordance with the provisions of Paragraph 596 of the Customs Regulations of 1908. The time for such airplanes, etc., to be admitted, however, will be limited strictly to three months and no extension on such bonds will be granted.

PUBLIC HEALTH SERVICE

(Treasury Department)

U. S. Quarantine regulations provide in general that aircraft operating between foreign ports and ports of the United States shall secure a United States Consular Bill of Health, and upon arrival in the United States, passengers and crew are subject to inspection by the quarantine officer of the port.

The United States Quarantine Regulations, however, grant exemption to vessels plying between "foreign ports on or near the frontiers of the United States and ports of the United States adjacent thereto," and this exemption applies to carriers, both maritime and aerial, plying between Canadian ports and ports of the United States, on the international rivers and lakes, likewise Mexican ports and American ports on the Rio Grande River, also those plying between Havana, Cuba, and Key West, Florida. Airplanes plying between interior points in Mexico and the United States, however, have to secure American Consular Bills of Health and are subject to quarantine examination at the port of destination in the United States.

AIRCRAFT IMPORTS AND EXPORTS

IMPORTS (U. S.)—CALENDAR YEAR 1920

	Rates of Duty	Quantities	Values	Duties
Airplanes	20%	78	\$178,028	\$35,605.60
Parts of				
Metal, chief value	20%		146,270	29,254.00
Wood, chief value	15%		61,567	9,235.05

EXPORTS (U. S.)

Export of previous years will be found in "Aircraft Year Book, 1921," p. 285.

1920

	<i>Airplanes</i>		<i>Airplane Parts</i>
	No.	Value	Value
November	1	\$ 2,000	\$ 906
December	8	50,100	29,969

1921

January	17	114,775	24,999
February .....	..	.....	24,213
March	1	15,000	10,921
April	2	15,000	5,486
May	7	29,500	37,673
June	3	19,500	7,837
July .....	..	.....	2,444
August	5	47,165	15,005
September	8	31,000	3,956
October	1	8,000	4,421
November .....	..	.....	19,173
December	4	35,000	1,480
Total 1921	48	\$314,940	\$157,608

BUREAU OF STANDARDS DEPARTMENT OF COMMERCE

PERSONNEL ENGAGED IN AIRCRAFT WORK

Dr. S. W. Stratton.....Director of Bureau
Dr. W. F. Hillebrand.....Chief of the Chemistry Division
Dr. C. W. Waidner.....Chief of Heat and Thermometry Division
Dr. G. K. Burgess.....Chief of Metallurgical Division
Dr. L. J. Briggs.....Chief of Engineering Physics Division
Prof. C. A. Skinner.....Chief of Optics Division
P. H. BatesActing Chief of Structural and Engineer-
ing Materials
E. C. CrittendenActing Chief of Electrical Division

The Bureau of Standards co-operates closely with the National Advisory Committee for Aeronautics in their research work. The Bureau is equipped with two wind tunnels and a third is in process of construction.

BUREAU OF FOREIGN AND DOMESTIC COMMERCE, AUTOMOBILE DIVISION

(Department of Commerce)

GORDON LEE, Chief; M. H. HOEPLI, Assistant Chief

In the middle of 1921 the Automotive Division was organized within the Bureau of Foreign and Domestic Commerce, Department of Commerce, to assist automotive manufacturers all over the United States in strengthening their position in foreign markets and expanding their activities abroad. Among groups of manufacturers represented in the Automotive Division are those of airplanes, including seaplanes. Information of interest to specific groups of manufacturers, such as the Aircraft Manufacturers, represented by the Aeronautical Chamber of Commerce, is communicated to a committee established for the purpose of maintaining a contact with the Automotive Division. Through association bulletins, this information is being transmitted to the members of these trade organizations. Data of a confidential character, such as trade opportunities, wherein the names of parties interested are mentioned, are communicated directly in the form of Special and Confidential Circulars to manufacturers listed on the "Exporters' Index."

AIR LAW SECTION

THE WADSWORTH BILL

67TH CONGRESS, 2D SESSION
S. 3076

IN THE HOUSE OF REPRESENTATIVES

February 15, 1922

Referred to the Committee on Interstate and Foreign Commerce

AN ACT

To create a Bureau of Civil Aeronautics in the Department of Commerce, to encourage and regulate the operation of civil aircraft in interstate and foreign commerce, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the Secretary of Commerce be, and he is hereby, authorized to establish in the Department of Commerce a bureau to be known as the Bureau of Civil Aeronautics.

SEC. 2. That the word "aircraft" as employed in this Act shall embrace every type of flying machine, conveyance, or vehicle now known or hereafter invented, devised, or developed, whether or not used in the carriage or transportation of persons or property, or without persons or property, flown, operated, or navigated in or through the air, and that the term "civil aircraft" as employed in this Act shall embrace all forms of aircraft except those operated by the Army and the Navy.

The term "commerce" when used in this Act means the flying, navigating, or operating of any civil aircraft in interstate or foreign commerce, or in, over, or through the District of Columbia, the Territories, dependencies, reservations, national parks, or over any place or building over which the United States has jurisdiction.

SEC. 3. That there shall be at the head of such bureau when established a Commissioner of Civil Aeronautics, who shall be appointed by the President, by and with the advice and consent of the Senate, who shall receive a salary of \$6,000 per annum. There shall be also a chief clerk of said bureau who, in addition to the usual duties of a chief clerk, may act as commissioner, under the direction of the Secretary, and such other deputies, assistants, and employees as may be required from time to time, and for which appropriations shall have been made, and the Secretary of Commerce may, at any time, utilize the services of such officers or employees of any other bureau or division of the Department of Commerce as he may deem necessary in the administration of this Act, or he may take from such bureaus or divisions

such parts thereof as he may deem advisable to create the Bureau of Civil Aeronautics or to consolidate such parts with that bureau.

SEC. 4. That it shall be the duty of the Secretary of Commerce, in conformity with the provisions of this Act, to foster civil aviation in every way possible and to do all things necessary therefor, cooperating or consulting with all other established governmental agencies, Federal or State, and taking advantage to the fullest degree possible of the facilities they can offer. This shall include the following duties:

(a) To inspect, in order to safeguard life and property, all aircraft before it is used in commerce and certify as to its condition, capacity, and safety at the date of inspection, and to make the information contained in such certificate available to the public in such manner as he may prescribe.

(b) To establish aerial traffic rules and regulations for the manner of navigating and operating civil aircraft in order to safeguard life and property.

(c) To investigate and recommend air routes.

(d) To encourage the establishment of landing fields and air stations.

(e) To make recommendations to the Weather Bureau as to the necessary meteorological service.

(f) To study the possibilities for the development of civil aviation in the United States and to collect and disseminate information relative thereto.

(g) To investigate, record, and make public the causes of accidents in civil aviation.

(h) To exchange with foreign Governments through existing governmental channels information pertaining to civil aviation.

(i) To operate and for this purpose to purchase, when appropriations shall have been made to do so, such aircraft as the Secretary of Commerce may deem necessary for inspecting, licensing, regulating, and controlling the operation of civil aircraft, and for determining air routes, landing fields, and air stations, Government machines to be used if possible and the consent of the department having control of the same can be secured.

(j) To prepare and maintain a comprehensive survey and inventory of all industrial and civil aeronautical resources under the jurisdiction of the United States. The Secretary may direct the Commissioner of Civil Aeronautics, or any other officer or employee referred to in section 3, to perform any or all of the aforesaid duties.

SEC. 5. That for the purpose of making effective the provisions of this Act the Secretary of Commerce shall direct the Commissioner of Civil Aeronautics to provide regulations, which shall become effective upon the approval of the Secretary of Commerce, for the following:

(a) Licensing pilots and such other persons engaged in commerce as may be required for the public safety and upon good cause the suspension or revocation of such licenses.

(b) The registration, identification, inspection, and certification of all civil aircraft in commerce.

(c) The registration, identification, inspection, and certification of all civil landing fields or air stations used in commerce.

SEC. 6. That no civil aircraft shall be used in commerce unless owned by a person who is a citizen of the United States or its dependencies, and in the case of a partnership unless each member is such citizen: *Provided*, That in the case of a corporation or association no such aircraft shall be owned by such corporation or association unless the president and board of directors or the managing officers thereof, as the case may be, are citizens of the

United States and the corporation or association itself is organized under the laws of the United States, or of a State, Territory, District, or possession thereof, and 75 per centum of the interest therein is owned by citizens of the United States.

SEC. 7. That all rules and regulations authorized under the provisions of this Act shall, by the direction of the Secretary of Commerce, be formulated by the Commissioner of Civil Aeronautics after consultation with other established governmental agencies concerned, and upon the approval of such rules and regulations by the Secretary of Commerce they shall be promulgated by him and shall have the effect of law and be enforceable from the date of such promulgation unless otherwise provided therein. The Secretary of Commerce shall have the power to suspend or revoke such rules and regulations and to alter or amend the same and promulgate new rules and regulations, such alterations, amendments, and new rules and regulations not to take effect until at least six months shall have elapsed, and to take such steps as he may deem necessary to bring such changes to the notice of those affected.

SEC. 8. That, by the direction of the Secretary of Commerce, the Commissioner of Civil Aeronautics shall, after consulting with other departments of the Government concerned, establish the conditions in order to safeguard life and property under which persons may be carried and property imported and exported in civil aircraft in commerce, and to prescribe the areas within which aircraft entering the United States, its Territories and dependencies, or the waters thereof, are to alight and the conditions to be complied with by such aircraft, which shall become effective upon the approval of the Secretary of Commerce.

SEC. 9. That the same rights, privileges, and treatment shall be accorded to alien pilots operating foreign aircraft in this country which the country of that alien extends to our pilots operating their machines in such country, except that any prohibition against our licensed pilots shall apply to such alien pilots.

SEC. 10. That it shall be unlawful for any licensed pilot to guide or control any aircraft, while engaged in commerce, in a manner designed to give a demonstration of trick flying or aerial acrobatics or to divert the aircraft from a normal flight.

SEC. 11. That it shall be unlawful to use any civil aircraft in commerce except in conformity with the provisions of this Act and such rules and regulations as may be promulgated pursuant thereto.

SEC. 12. That any violation of the provisions of this Act, or of any rule or regulation promulgated in conformity therewith, shall be punishable by a fine not exceeding \$500 or by imprisonment for a term not exceeding six months, or both.

SEC. 13. That the Secretary of Commerce and such assistants as he may designate shall have power to conduct hearings, to subpoena witnesses, to send for documents and other papers, to administer oaths, and to take such testimony as may be necessary in determining the qualifications of individuals for licenses or registration certificates to operate aircraft or in the suspension or revocation of such licenses or registration certificates, or to enable him, or them, to make effective any of the provisions of this Act, or any rule or regulation promulgated in conformity therewith.

SEC. 14. That the Secretary of Commerce is authorized to fix the fees and charges for such inspection, registration, and licensing authorized by this Act to cover the cost thereof, which fees and charges shall be collected by

the Secretary of Commerce and covered into the Treasury of the United States to the credit of miscellaneous receipts.

SEC. 15. That for the purpose of encouraging the development of civil aviation in the United States, full cooperation shall be given by the Secretary of Commerce to the owners or operators of civil aircraft, and that the Secretary of War, the Secretary of the Navy, the Secretary of the Treasury, the Postmaster General, and the Secretary of Commerce may, in cases of emergency, sell to any owner or operator of civil aircraft landing on an air station or landing field under their respective jurisdictions, aviation fuel, oil, supplies, and provide necessary mechanical services of an emergency character, under such regulations as they may approve and promulgate for their respective services. The proceeds from such sales and services shall be deposited in the Treasury of the United States to the credit of the appropriations involved.

SEC. 16. That the Secretary of Commerce shall publish annually a bulletin setting forth all licenses issued or revoked, together with field reports of all flying activities, accidents, and field and route data, under the control of the bureau.

SEC. 17. That the Commissioner of Civil Aeronautics shall annually, at the close of each fiscal year, make a report to the Secretary of Commerce, giving an account of all moneys received and disbursed by him and describing the work done by the bureau, and the Secretary of Commerce shall transmit such report to Congress with the annual report of the Department of Commerce.

SEC. 18. That all salaries provided herein and all expenses incurred under the provisions of this Act shall be paid out of such money as may be appropriated therefor by Congress, and such appropriations as may be needed to carry out the objects and purposes of this Act are hereby authorized.

SEC. 19. That the Secretary of Commerce be, and he is hereby, authorized to make such additional rules and regulations as may be necessary to carry out the provisions of this Act.

SEC. 20. That if any portion of this Act be declared invalid, it shall not affect any of the other portions thereof, which other portions shall continue in full force and effect.

SEC. 21. That this Act shall take effect immediately, and all Acts or parts of Acts inconsistent herewith are hereby repealed.

Passed the Senate February 13 (calendar day, February 14), 1922.

Attest:

GEORGE A. SANDERSON,
Secretary.

WARNING ISSUED BY NATIONAL VIGILANCE COMMITTEE, ASSOCIATED ADVERTISING CLUBS OF THE WORLD, H. J. KENNER DIRECTOR, CONCERNING PROFESSIONAL PROMOTERS OF AIR TRANSPORTATION COMPANIES

[New York, Feb. 11, 1922]

It has come to the attention of the National Vigilance Committee that various professional promoters are active in many sections of the country, either in the sale of shares in air transportation companies, promising large

returns to investors, or setting up machinery which will enable them at some later date to sell interests in such companies.

In some instances, promoters have gathered around them men of some aviation experience, who have thus far enjoyed good reputations, and have with the names of these men and their past aviation experience bought or borrowed respectability to create confidence without which the professional promoter is lost.

In other instances, promoters have forwarded their plans for separating a gullible citizenship from its savings by the hurrah method of trading upon the community spirit of cities solicited to provide station sites and franchises that will "put them on the air transportation map" and inspire the envy of some less fortunate rival city. This may lead to the appointment of an "aeronautics committee" of the Chamber of Commerce to work for the coming of ships of the air,—a form of recognition which amounts to endorsement. With news items in the local press, this provides the "set-up" upon which promoters' agents will cash in when stock-selling time rolls round, as it inevitably does.

Promoters of this type are as bold as they are resourceful. Not only do they fairly ooze "facts and figures" about aeronautics of which the "prospect" knows nothing and which are used to mislead, but also they snare his savings by firing his imagination with the romance and glory of this new art and industry which national defense has brought so prominently to the fore. They intimate that Chambers of Commerce are financially backing their efforts; that rich capitalists are advancing all the money needed to do preliminary organization work; that profitable contracts with the Post Office Department and the Express Companies are practically in their pockets; and they talk glibly of "government cooperation," and "official connections." These, and many other representations which dazzle even skeptical City Fathers, have in them more of deception and fraud than of truth and honesty.

Some of these promoters, bolder perhaps and more versed than others in the art of large-scale fakery, claim to possess planes, often juggling with the names of famous designers in a way to impress the layman. Such promoters may even have a plane or two—built to order, of course, for stock-selling purposes—but not fitted for freight and passenger carrying service at a profit. In this connection, however, it should be remembered that promoters who have attained the rank of "professionals" do not make the mistake of having no goods to show when they launch a stock-selling campaign. Pandolfo built motor cars at "Pan-Town-on-the-Mississippi" and the fraudulent Emerson Motors Company of New York had a real factory.

Commercial aviation has a bright future in America. But it is a future which must be realized by the sane, clear-headed men in industry and finance. There is no need to rush it. Haste means waste. It means public confidence undermined by unrealized hopes of promise-fed investors. Wildcatters who would sell huge issues of stock without making clear to the investing public that it takes a long chance on such enterprises in this undeveloped field of air-travel are certain to injure seriously the development of the industry.

Such promoters are insincere or worse. They are not entitled to public confidence. They have little to lose but their time. Their gains roll high with the sale of stock, out of which they reward themselves richly, not only by means of liberal commissions on the sale of stock, but by organization and preorganization expenses and various other remunerative "costs" which the "investors" and not the promoters pay.

Furthermore, even honest air-transportation projects, from the viewpoint of investors, must necessarily be considered in the extremely speculative class until there is adequate Federal legislation regulating travel by air. No such legislation exists now and until it is enacted the public had best refrain from attempting flyers in such ventures. The enthusiasm and energy which Chambers of Commerce may devote to putting their communities "on the air map" can find safer and more profitable exercise than through advancing the plans of the air route promotor who has scant respect for legal safeguards and regulations. It is desirable that municipalities set aside landing fields for public use but they should be wary of extending exclusive privileges to stock-selling schemers.

Commercial aviation—the great, new development in transportation—is being put forward soundly by men of experience in aeronautics and the automotive industry who have their feet on the ground. It should not be permitted to become a means by which weavers of fantastic schemes may enrich themselves at the expense of a public whose admiration and enthusiasm for a marvelous development make them easy victims for persons of predatory instincts.

To prevent exploitation of the credulous public and consequent vital injury to an important, promising industry, honest business men and reputable publications are urged to act:

First:—By following the advice:

"Before you Invest—Investigate."

Second:—By reporting doubtful schemes to
the National Vigilance Committee,
110 West 40th Street, New York City.

AIRCRAFT INSURANCE

NATIONAL AIRCRAFT UNDERWRITERS' ASSOCIATION

13 Park Row, New York City

OFFICERS

Edmund Ely (Ætna Life)President
E. Stockton Martin (Home).....Secretary-Treasurer
Ambrose Ryder (N.A.U.A.).....Manager

The National Aircraft Underwriters' Association is composed of twenty-nine insurance companies who are either writing aircraft insurance or interested in it one way or another.

Prior to the Spring of 1919 no special aircraft policy form had been adopted. Coverage was extended by applying riders, to the existing forms of automobile or fire policies. The underwriters of the various companies soon felt the need of an interchange of ideas and information to assist them in properly classifying the hazards involved. For this purpose there was formed in March, 1920, an Association of underwriters who adopted the name "National Aircraft Underwriters' Association." The objects of the Association as outlined in the original constitution are: (1) To serve as a medium of exchange of information. (2) To supervise and recommend the adoption of suitable policy forms and endorsements. (3) To investigate class and general hazards and to procure and compile information and statistics concerning losses and their causes and to devise, advocate and promote all reasonable and proper means of eliminating or reducing the hazards against and to promote intelligent understanding.

Since formulation of the constitution, the activities of the Association have been broadened to include: (1) Preparation of model specifications for hangars and landing fields, which are available to municipalities and private corporations. (2) Inspection of aircraft and factory production methods (through the Underwriters' Laboratories, Inc.). (3) Compiling accident data. (4) Analysis of accidents with view to measuring and placing the hazard. (5) Cooperation with the Bureau of Standards in fixing standards for material, manufacture and operation. (6) Cooperation with the Underwriters' Laboratories in registration and classification of aircraft and pilots and the compilation of an Aircraft Register. (7) Compilation of experience and formulation of rates and coverages.

Various forms of coverage available at present are Fire, Theft, Collision (Land planes); Windstorm, Cyclone or Tornado (Land planes); Flight Collision (Seaplanes); Mooring perils (Seaplanes).

In order to make this insurance available to the average user of aircraft the insurance companies have endeavored to keep the rates as low as possible. The rates are necessarily high, but high as they are, the business has been a losing one so far, and several insurance companies have retired altogether from the field. It is expected however that the inevitable development of aircraft rules and Federal regulation will ultimately put the aircraft insurance business on a sound basis at attractive rates.

COLLEGES AND SCHOOLS OFFERING COURSES IN AERONAUTICS

Armour Institute of Technology, Chicago, Ill.	Research University, Washington, D. C.
California Institute of Technology, Pasadena, Cal.	Stanford University, Stanford, Cal.
Cornell University, Ithaca, N. Y.	State University of Iowa, Iowa City.
Indiana University, Bloomington, Ind.	University of California, Berkeley.
Massachusetts Institute of Technol- ogy, Cambridge, Mass.	University of Detroit, Detroit, Mich.
Purdue University, Lafayette, Ind.	University of Illinois, Urbana, Ill.
Rensselaer Polytechnic Institute, Troy, N. Y.	University of Michigan, Ann Arbor.
	University of Wisconsin, Madison, Wis.

Those desirous of taking actual flight instructions are advised to apply to the nearest member of the Aeronautical Chamber of Commerce of America, Inc. Addresses may be found in the Commercial Section of the Appendix.

LANDING FIELDS FOR AIRCRAFT IN UNITED STATES, DECEMBER 31, 1921

(From U. S. Air Service)

<i>State</i>	<i>Federal</i>	<i>Municipal</i>	<i>Commercial</i>	<i>Unimproved Facilities</i>	<i>Total</i>
Alabama	2	1	3	37	43
Arkansas	1		1	29	31
Arizona	3	2		15	20
California	9	15	34	91	149
Colorado		4	9	23	36
Connecticut	1	1	5	6	13
Delaware			1	2	3
Dist. of Columbia.....	2				2
Florida	4	12	10	41	67
Georgia	6	8	6	35	55
Idaho		2	1	22	25
Illinois	4	3	9	124	140
Indiana	1	3	14	29	47
Iowa	2	2	8	22	34
Kansas	2	3	6	30	41
Kentucky	1		2	8	11

LANDING FIELDS AND AIR TERMINALS

231

<i>State</i>	<i>Federal</i>	<i>Municipal</i>	<i>Commercial</i>	<i>Unimproved Facilities</i>	<i>Total</i>
Louisiana	2	2	2	15	21
Maine			3	11	14
Maryland	4		1	13	18
Massachusetts	4		11	27	42
Michigan	2	2	9	44	57
Minnesota		5	3	32	40
Missouri		4	5	42	51
Mississippi				21	21
Montana	1	5	3	36	45
Nebraska	1	2	3	11	17
Nevada		2	1	12	15
New Hampshire			2	4	6
New Jersey	3	1	10	6	20
New Mexico	2	7	2	20	31
New York	6	8	27	49	90
North Carolina	2	1	3	15	21
North Dakota			1	20	21
Ohio	3	2	9	19	33
Oklahoma	1	6	13	60	80
Oregon		6	8	19	33
Pennsylvania	4		9	34	47
Rhode Island	1	1	3	10	15
South Carolina	1		10	8	19
South Dakota			1	3	4
Tennessee	1	1	2	22	26
Texas	12	8	5	139	164
Utah		3	1	13	17
Vermont		2	3	4	9
Virginia	2	1	4	25	32
Washington	3	2	9	27	41
West Virginia	1	1	1	11	14
Wisconsin		4	7	29	40
Wyoming	1	5	2	12	20
Total	95	137	282	1327	1841

(Reports from 125 operators, made to the Aeronautical Chamber of Commerce, show that in 1921 there were 146 air ports available. Thirty of these were seaplane bases. Of the 146, sixteen were publicly owned or controlled.)

CHRONOLOGY OF AERONAUTICS

JANUARY 1—DECEMBER 31, 1921

(For Earlier Chronologies, see "Aircraft Year Book," 1919, 1920 and 1921)

* See amplification at close of chapter.

- Jan. 1 Flying Boat mail service established by War Department between large towns in Philippines.
- Jan. 1 U. S. Navy Seaplane, N.C.-5, makes non-stop flight with 6 persons from San Diego to Magdalena Bay, 702 mi., in 9 hrs. 15 min.
- Jan. 1 British Air Ministry authorizes subsidies of £60,000 for civilian aviation 1921-1922.
- Jan. 1 Wright Aeronautical Corp. changes name of improved American Hispano motor to Wright Engine.
- Jan. 3 New Zealand establishes Air Mail Service modeled after U. S. Air Mail.
- Jan. 7 Aeromarine Engineering & Sales Co. is made distributing agent for \$4,000,000 worth of U. S. Navy surplus aircraft and engines.
- Jan. 10 New 700 h.p. W. motor, 18 cyl., is tested by Army Air Service at McCook Field, Dayton, Ohio.
- Jan. 15 Twelve Navy F.-5-L seaplanes complete 3200 mi. flight from San Diego to Canal Zone, Panama, with 9 stops, in 17 days.
- Jan. 17 Aviation Units, Minnesota National Guard, recognized by War Department.
- Jan. 20 President of France acquires airplane for official tours.
- Jan. 23 Aviation Meet at Marina, San Francisco, 25 planes participating.
- Jan. 25 Committee on Law of Aviation, American Bar Association, files initial report on necessity for aerial law.
- Jan. 26 Letter mailed in Los Angeles Jan. 24 is delivered by Air Mail in New York 48 hrs. later, less than half the time required by train.
- Feb. 4 Fifteen D.H.-4-B. bombing planes from Mitchel Field, Army Air Service, "raid" New York City with smoke bombs.
- Feb. 12 First American National Airway—Washington, D. C., to Dayton, Ohio—is opened by Army Air Service at Bolling Field.
- Feb. 22 Sergt. Encil Chambers makes parachute jump, 22,200 ft., Fort Sill, Okla.
- Feb. 23 Jack Knight and E. M. Allison, mail pilots, fly mails from San Francisco to New York in 33 hrs. 20 min., Knight flying at night from North Platte, Nebr., to Chicago.

- Feb. 24 Lt. W. D. Coney, U. S. A. S., completes transcontinental flight from San Diego, Cal., to Jacksonville, Fla., 2180 mi. in 22 hrs. 27 min.
- Feb. 25 Aeromarine Airways 11-passenger flying cruiser *Ponce de Leon* completes service facilities survey of Eastern Atlantic Coast, New York—Miami, Fla.
- Feb. 25-28 International Conference, Air Transport Companies, held at Brussels.
- Mar. 4 U. S. Army Air Service buys semi-rigid dirigible *Roma* from Italian Govt. for \$200,000.
- Mar. 9 Five men make parachute jumps simultaneously from one Army Air Service plane at Mather Field, Cal.
- Mar. 15 Two J.L.-6 (Larsen) monoplanes with skis complete long exploring flight from Peace River to Great Slave Lake, Alberta, Can.
- Mar. 16 U. S. Public Health Service starts aerial survey of water courses in Mississippi Valley.
- Mar. 17 U. S. Marine Corps establishes aviation station at Sumay, Guam.
- Mar. 23 Lt. Arthur G. Hamilton, U. S. A. S., makes record parachute jump, 23,000 ft. at Rantoul, Ill.
- Mar. 23-Nov. 30 U. S. Naval seaplanes used in revising sailing charts of Mississippi River Delta.
- Mar. 26-28 National Southern Air Tournament opens Clearwater—Belleair, Fla.
- Mar. 26 Curtiss-Wright Army airplane stops within 15 ft. by means of reversible propeller, at Belleair, Fla.
- Mar. 27 Aviation units are authorized for New York Natl. Guard.
- Mar. 28 First seal hunt by airplane, off Botwood, N. F.
- Mar. 31 Capt. Lowell H. Smith, U. S. A. S., with detachment 91st Aero Sqdrn., completes aerial survey of cyclone area Olympic Peninsula, Wash.
- April 7 Third Annual Aviators' Ball held at Waldorf-Astoria, New York.
- April 11 Bill is introduced into the House by Representative Julius Kahn, to regulate air navigation within the United States and dependencies, and between the United States and any foreign country.
- April 11 Bill 2815 is introduced into the House by Representative Frederick C. Hicks, creating a Bureau of Civil Aviation in Department of Commerce.
- April 12 President Harding, in his address to Congress, recommends the establishment of a bureau of aviation in the Dept. of Commerce for the Federal regulation and encouragement of air navigation.
- April 13 Poirer in Caudron wins seaplane races at Monaco, Italy.
- April 15 Commercial blimp, *Goodyear*, is used in aerial survey, Los Angeles.
- April 17 Aviation meet at Oklahoma City, Okla.
- April 18 Dean Ivan Lamb flies across Central American Andes, Sula to Tocantin, Honduras, 18,000 ft. alt., in a Bristol.
- April 18 Airplanes carry out extensive mercy patrol work during

- violent earthquakes in Argentina and Chile, being the only means of communication in devastated areas.
- April 22** Secretary of the Navy and other officials witness launching of first Aeromarine Navy civilian flying boats on Potomac River at Washington.
- April 22** Lt. Col. T. C. Turner with two U. S. Marine Corps D.H.-4-B. planes arrives back in Washington, D. C., after 4842 mi. round trip flight to Santo Domingo.
- April 23** First Air Sqdrn., U. S. Marine Corps, completes photo mosaic map of Dominican Republic coastline.
- April 27** Resolution submitted to Chamber of Commerce of U. S. at Atlantic City convention by National Aircraft Underwriters Assn., urging aerial code.
- April 30-Nov. 25** Foster Russell Aviation Co., Spokane, Wash., makes 20,000-mi. flight, visiting 75 towns and carrying 2000 passengers. Expedition made to advertise 30 Spokane manufacturers in the "Inland Empire." No accidents; no forced landings.
- May 2** Giovanni Ancillato flies over Peruvian Andes, 16,000 ft. alt., in Ansaldo.
- May 6** Organization of 1st Provisional Air Brigade, U. S. Army Air Service, Langley Field, Va.
- May 6** Lt. J. A. Macready and Roy S. Langhan in Packard Lepere biplane make record two man alt. flight, 34,150 ft. (indicated) over McCook Field, Dayton, Ohio.
- May 7** S. V. A. Ansaldo flies New York to Chicago in 7½ hrs.
- May 8** Army Air Service holds annual flying meet at Mitchell Field, L. I.
- May 10** Ten American members of Kosciusko Sqdrn. decorated by President of Poland for services in Bolshevik campaign.
- May 13** French Committee on Aeronautics Propaganda announces prize of 1,000,000 fr. (\$70,000) for best airplane motor.
- May 15** Aviation Club House of Aero Club of America opened at Curtiss Field, L. I.
- May 15** U. S. Air Mail Service celebrates 3rd anniversary.
- May 19** Secretary of the Navy, sixty-two Senators and Congressmen take flights and watch photographs taken in the air and printed within 18 min. while planes are in flight.
- May 23** Ralph Upson and C. G. Andrus win National Balloon Race, Birmingham, Ala.—Stuart, Va., 425 mi.
- May 28** Fred Lemon makes record low altitude parachute jump, 150 ft., at El Reno, Okla.
- May 31** New York-Washington Air Mail Service discontinued by lack of appropriations.
- June 1** Aeromarine Airways transports 1044 passengers with baggage and mails between Key West and Havana in 6 months. Starts intercity flying boat service at New York.
- June 1** U. S. Weather Bureau starts daily flying weather bulletins.
- June 6-8** National Aeronautical Congress at Turin, Italy.
- June 10** Lt. Alex. Pearson, U. S. A. S. makes aerial survey of Grand Canyon of Arizona.

- June 10 First Sergeant Luis Barrufaldi, an Argentine, breaks South American altitude record, ascending 24,272 feet.
- June 11 Lt. R. C. Moffat, U. S. A. S., wins Hamilton Memorial Trophy Race, Hartford, Conn.—Springfield, Mass.
- June 14 Georges Kirsch reaches alt. 32,153 ft. in Nieuport, in France.
- June 14 Mooring Mast for airships operated in Pulham, England.
- June 15 U. S. Marine Corps aviators make aerial survey of Haitian coastline.
- June 21 German Submarine "*U-117*" sunk by bombs dropped by Navy F-5-L planes in 1st aerial warfare demonstration off Virginia Capes.
- June 23 Airship Z.R.-2 (R.-38) makes trial flight over Cardington, Bedford, Eng.
- June 26 Georges Kirsch reaches height of 32,889 ft. over Versailles, France, in a Nieuport.
- June 28 Radio fog signals established on Atlantic coast.
- June 29 U. S. S. "*Iowa*," radio-controlled, used as target for Navy and Marine Corps bombers, with dummy bombs, in 2nd phase aerial warfare demonstration.
- June 30 Cairo-Bagdad air route opened by British Royal Air Force.
- July 1 Eddie Hubbard completes first Government mail contract, with 100 per cent efficiency service, carrying 927,000 letters between Seattle and Victoria in 8½ mos.
- July 1 French aerial transport started between France and Casablanca, Morocco.
- July 2-4 Three Army Air Service planes from Fort Sill, Okla., patrol and relieve flooded district, Pueblo, Colo.
- July 2 Royal Air Force Pageant at Hendon, London, Eng.
- July 4 Photographs Carpentier-Dempsey fight delivered by planes in San Francisco 48 hrs. 45 min. after leaving Hoboken, N. J.
- July 9-11 Prof. Bailey Willis, president, Seismological Society of America, makes aerial study of San Andreas rift, the line of earthquakes of 1857 and 1906 in California Coast Range.
- July 13 German destroyer "*G-102*" sunk by Army and Navy bombers in 3rd phase of aerial warfare demonstration.
- July 14 Aircraft review at Langley Field, Va., 61 planes exhibited.
- July 16 John H. James wins British Aerial Derby at Hendon, London, 100 mi. in 1 hr. 13 min. 28 sec., aver. rate 163.34 m.p.h.
- July 16-17 International Air Tournament at Los Angeles.
- July 17-Sept. 28 C. O. Prest flies in Curtiss J.N.-4 with OX-5 engine, 3206 miles from Los Angeles to Rupert, Alaska. Remarkable flight.
- July 18 German Cruiser "*Frankfurt*" sunk by Army and Navy bombers in 4th phase aerial warfare demonstration.
- July 18 Conference on aerial law between Secretary of Commerce and representatives of civilian aviation.
- July 20 Airplanes rescue inhabitants of flooded district in New South Wales, Australia.

- July 20-21 German Dreadnaught "*Ostfriesland*" sunk by Army bombers in 5th phase aerial warfare demonstration.
- July 28 Annual meeting and election of officers Manufacturers Aircraft Association, 501 Fifth Avenue, New York.
- July 29 Brig. Gen. Wm. Mitchell leads 17 bombing planes in "raid" over New York.
- July 30-31 Aviation Meet at Denver, auspices Colorado Aero Club.
- Aug. 1 Eduardo Olivero makes South American record alt. flight, 26,240 ft., over Sao Paulo, Argentine.
- Aug. 1 First cross-country flights with gliding (motorless) airplanes. Dr. Klemperer soars from Wasserkuppe to Gersfeld, Germany, 5 mi., rising 400 ft. above starting point.
- Aug. 1 U. S. Navy airship hangar completed at Lakehurst, N. J. Erection of mooring mast started.
- Aug. 1 Secretary of War prohibits stunt flying over towns.
- Aug. 4 5000 catalpa trees near Troy, Ohio, successfully sprayed from airplane in 15 min.
- Aug. 6-7 DeBriganti wins Schneider Maritime Aviation Cup at Venice, Italy, in Macchi flying boat.
- Aug. 15 Gallaudet Aircraft Corp. completes multiple engine drive and geared propeller system at East Greenwich, R. I.
- Aug. 15 U. S. Air Mail Service completes wireless communication system New York-San Francisco.
- *Aug. 16 Loening Monoplane *Flying Yacht* makes alt. record flight for hydro-airplanes, 19,500 ft., with 4 persons, over Port Washington, N. Y.
- Aug. 24 Dirigible airship Z.R.-2 (British R.-38) collapses in flight over Hull, Eng., 44 officers and men of Royal Air Force and American Navy lost.
- Aug. 24 Bill 2448 introduced into Senate by Senator James W. Wadsworth, Jr., to create a Bureau of Civil Aviation in the Department of Commerce.
- Aug. 25 American Bar Association recommends Federal aerial legislation.
- Sept. 2 U. S. Marine Corps planes locate entire hidden "moonshine" village on Atlantic Coast.
- Sept. 5 Sadi Lecoq wins aviation Grand Prix at Breavia, Italy, 186.41 mi. in 1 hr. 13 min. 19 sec.
- Sept. 6 Martens in Germany makes new gliding record with motorless plane, remaining aloft 15 min. 40 sec.
- Sept. — Des Moines, Ia., business men purchase air mileage books for 10,000 miles of travel by plane.
- Sept. 9 Benedict Crowell elected President Aero Club of America, succeeding Myron T. Herrick; H. E. Hartney elected Executive Secretary, succeeding Maurice G. Cleary.
- Sept. 11 Aeromarine Navy *H.S.-2* returns to New York after 7491 mi. round trip flight to Chicago, via St. Lawrence and around the Great Lakes. D. G. Richardson, pilot.
- Sept. 15 Capt. F. E. Guest, British Secretary of State for Air, visits U. S.
- Sept. 17 Capt. Paul Armbruster, Swiss aeronaut, wins International Gordon Bennett Balloon Race, from Brussels to Lamby Is., Ireland, 515.14 mi.

- Sept. 25 Sadi Lecointe makes speed of 330 km.p.h. (204.6 m.p.h.) in Nieuport, near Paris, France.
- Sept. 25 Aeromarine Airways H. S.-2 flying boat *President Zayas* arrives in Havana, Cuba, from New York, in 19 hrs. flying time.
- Sept. 26 U. S. Army-Air Service completes aerial warfare tests against U. S. S. "*Alabama*" in Chesapeake Bay.
- *Sept. 27 Aeromarine Airway 11-passenger flying boat *Santa Maria* arrives at New Orleans after 9000 mi. flight from Havana to New York, Montreal, Detroit, Chicago, Memphis, carrying total of 2000 passengers.
- *Sept. 28 Lt. J. A. Macready, U. S. A. S., makes world's altitude record, indicated 40,800 ft., true alt. above sea level 37,800 ft., at McCook Field, Dayton, Ohio, in same Packard Lepere biplane with supercharger in which Maj. Rudolph Schroeder made former world's record of indicated alt. 38,180 ft. and corrected or true above sea level 33,000 ft., over Dayton, Ohio, February, 1920.
- Sept. 28 U. S. Ordnance Bureau tests 4300 lb. aerial bomb at Aberdeen, Md.
- Sept. 30 47 Army Air Service planes during forest fire season 1921, operating from Pacific Coast bases, discover 832 forest fires in 396 patrols, flying 148,113 mi. over area of 7,230,459 sq. mi. National Parks.
- Oct. 1 Aerial torpedo plane, radio controlled, is tested, Long Island to Pennsylvania.
- Oct. 1 Georges Kirsch wins Deutsche de la Meurthe Cup Race at Etampes, Fr., flying 186 mi., 3 turns, in 69 min. 55 sec.; average speed 173. m.p.h.
- Oct. 2 U. S. Marine Corps planes complete five days maneuvers with East Coast Expeditionary Force at Wilderness Run, Va., making 204 flights, 10,500 mi. flown.
- Oct. 2 J.L.-6 (Larsen) armored monoplane with 30 machine guns, exhibited at Bolling Field, Washington, D. C.
- Oct. 7 Loening Monoplane *Flying Yacht* flies 188 mi. in 80 min., Aberdeen, Md., to Port Washington, N. Y.
- Oct. 11 Lt. Howard K. Ramey, U. S. A. S., in D.H.-4-B makes record flight Washington-New York, 220 mi. in 79 min.
- Oct. 14 Loening Monoplane *Flying Yacht*, at efficiency contest held by Aero Club of America, establishes new seaplane efficiency record, making six round trips between Port Washington and New London, in 5 hrs. 33 min., 24 passengers carried in all, total cost of operation \$65.
- Oct. 16 Aero Club of America holds aviation meet at Curtiss Field, Garden City, N. Y.
- Oct. 31 U. S. Navy hydroairplane is launched from catapult.
- Oct. 31 American Legion Flying Meet, during National Convention at Kansas City, Mo., 100 planes participating. Curtiss and J.L.-6 planes with passengers fly from New York prior to events.
- Nov. 1 Opening of the Peking-Tsinan aerial service.
- Nov. 1 Charles "Casey" Jones in Curtiss *Oriole*, C.-6 motor, wins

- American Legion Junior Derby, Kansas City, Mo., 87½ mi. in 53 min. 53 sec.
- Nov. 2 American Legion at National Convention, Kansas City, Mo., adopts resolution urging Congress to create Bureau of Civil Aviation in Dept. of Commerce.
- Nov. 2 Lloyd Bertaud in Balilla Ansaldo plane, C-12 motor, wins American Legion Senior Derby, Kansas City, Mo., 140 mi. in 60 min. 15 sec.
- Nov. 3 International Aero Congress, Omaha, Nebr.
- *Nov. 3 Bert Acosta, in Curtiss-Navy Racer, C-12 motor, wins Pulitzer Trophy Race at Omaha, Nebr., 153.59 mi., 14 turns, in 52 min. 9 sec.; average speed 176.7 m.p.h.; world's record for closed course.
- *Nov. 3 Lt. J. A. Macready wins second place in Pulitzer Race in Thomas-Morse M.B.-6 biplane, 300 h.p. Wright motor at speed of 160.71 miles an hour.
- Nov. 4 Charles "Casey" Jones wins 90 mi. free-for-all race at Omaha, Neb. in Curtiss *Oriole*, C-6 motor, 55 min. 5 sec.
- Nov. 5 Eddie Stinson, in J.L.-6 monoplane, wins Larsen Efficiency Trophy contest at Omaha, Nebr.
- Nov. 11 Third Armistice Dinner and Aviators Reunion, held at Commodore, New York, by Aero Club of America.
- Nov. 12 Conference for Limitation of Armaments convenes at Washington, D. C.
- Nov. 15 Semi-rigid airship *Roma* makes initial American flight at Langley Field, Va.
- Nov. 22 Bert Acosta, in Curtiss-Navy Racer makes speed of 197.8 m.p.h. at Curtiss Field, Garden City, L. I., N. Y.
- Nov. 27 Seventh International Aeronautical Exposition closes in Paris.
- Dec. 1 Helium used successfully in first practical test, in C.-7 Navy blimp, over Norfolk, Va.
- Dec. 15 U. S. Circuit Court of Appeals reverses U. S. District Court and holds that Glenn H. Curtiss was the first person to invent and operate a hydroairplane or flying boat. Decision final.
- Dec. 15 Aircraft Carrier U. S. S. *Langley* delivered to Navy Dept.
- *Dec. 29-30 Eddie Stinson and Lloyd Bertaud in Larsen J.L.-6 monoplane, B.M.W. 185 h.p. motor, break world endurance record at Roosevelt Field, L. I., N. Y., remaining aloft in continuous flight 26 hrs. 19 min. 35 sec., breaking former record made by Boussoutrou and Bernard in Farman *Goliath* in France, June, 1920, 24 hrs. 19 min. 7 sec.
- Dec. 31 The Aeronautical Chamber of Commerce of America, Inc., is organized with offices at 501 Fifth Avenue, New York.

THE SANTA MARIA'S INLAND FLIGHT

The flight of the Aeromarine-Navy Flying cruiser *Santa Maria* from Key West, Fla., along the Atlantic seaboard, over the waterways of New York State, along the Great Lakes, down the Mississippi and along the Gulf Coast, was one of the outstanding flights of a year replete with continuous demon-

stration of the practicability of commercial aerial transport. The *Santa Maria* traveled 7000 miles on that trip alone. She flew 2725 miles more at the cities visited en route. Her log shows that from the time she was launched at Keyport, N. J., by Governor E. I. Edwards in June, 1920, the *Santa Maria* has flown upwards of 25,000 miles and carried thousands of passengers.

The long flight in the summer of 1921 was made to sell commercial aviation to the people living on our inland waterways. The *Santa Maria* left Key West, April 10, 1921, and flew to Miami. She left Miami the following day and flew to Washington, D. C., where many Government officials and Cabinet members were flown, occupying Pullman chairs in the fore and aft cabins which ordinarily accommodate eleven persons besides the crew.

Leaving Washington the *Santa Maria* participated in the review of the Fleet by the President and proceeded to New York City. On May 11 she flew up the Hudson to Newburgh where a civic holiday had been declared in honor of her arrival. Among her passengers were Admiral C. J. Peoples, U. S. N.; Dr. James W. Inches, Police Commissioner of Detroit; Mr. and Mrs. Howard E. Coffin, Colonel Herbert Alden, W. E. Metzger, of Detroit, and C. F. Redden, President of Aeromarine Airways, operators of the craft.

Albany, Lake George, Plattsburg, Montreal turned out to greet the flying boat, crowds lining the waterfront at the hour scheduled for her arrival. From Montreal to Toronto the *Santa Maria* traversed the St. Lawrence, and thence from Buffalo to Detroit across Lake Erie. From Detroit the flying boat flew around the lower Michigan Peninsula to Chicago where she participated in the Pageant of Progress and daily carried scores of distinguished visitors on short flights over the city, at the same time showing motion pictures on a screen hung at one end of the forward cabin.

From Chicago to New Orleans the flying boat blazed an aerial highway, Comdr. P. N. L. Bellinger, commander of the N.C.-1 on the transatlantic flight, and Congressman Frederick C. Hicks, Chairman of the House Committee on Naval Affairs, heading the delegation with letters from the Secretary of the Navy urging each municipality to make its waterfront a port of call for flying craft.

LOENING EFFICIENCY FLIGHT

Before a large group of persons interested in the various phases of the development of American commercial aviation, the Loening Monoplane *Air Yacht* went up over Port Washington, L. I., New York, on Aug. 16, 1921, carrying four persons to a height of 19,500 feet, a new world's record for seaplane height. The pilot, David McCulloch, who piloted the N.C.-3 during the transatlantic flight, said that he could have gone higher had it not been for the cold. The climb to 19,500 feet was reached in 48 minutes after leaving the ground with an air speed of about 85 miles an hour. The passengers included Ladislav d'Orcy, Editor of *Aviation*; L. R. Grumman and Grover C. Loening, President of the Loening Aeronautical Engineering Corp., N. Y. C., who designed the *Air Yacht*, having worked on it with many interruptions since 1912. With a wing span of 43 feet and powered with one Liberty motor, the seaplane carried 1400 pounds useful load, and has made a speed in the air of 122 miles an hour.

The former seaplane altitude record for four persons was 9600 feet, and the performance of the Loening *Air Yacht*, in reaching 19,500 feet, clearly demonstrated the engineering ability being displayed in American aviation.

MACREADY'S RECORD ALTITUDE FLIGHTS

"Altitude flying cannot be gauged by engine superchargers but by the physical limitations of the pilot," said Lieutenant John A. Macready, U. S. Army Air Service test pilot at McCook Field, on making his report of his record altitude flight Sept. 28, 1921, when he flew a Packard Lepere biplane with supercharger to a true altitude of 37,800 feet above sea level and indicated 40,800 feet on his barograph. He used the same plane with which Major Rudolph Schroeder won the record in February, 1920, when he reached an indicated height of 38,180 feet and a true altitude above sea level of 33,000 feet.

"For over a year I have been trying to reach the highest altitude but something always broke," wrote Macready. "On this occasion I gained confidence as altitude was gained and the entire mechanism functioned better than ever before. I began using oxygen at 20,000 feet, sparingly at first in order to save it. Over my military uniform I wore a heavy suit of woolen underwear and over this a thick, heavily padded leather covered suit made of down and feathers. On my feet were fleece lined leather moccasins and I wore fur-lined gloves. My leather helmet was lined with fur and an oxygen mask was attached to it. The goggles were separate and on the outside. The inside of the goggles was covered with a film of secret gelatin compound painted over the glass to keep ice from forming. The oxygen supply led from five flasks and an emergency flask through a tube into my mouth.

"I felt no ill effects whatever until well above 30,000 feet, as I was getting plenty of oxygen and was warm enough, but then a slight slowing up of senses and faculties was noticeable, and this feeling increased. Any exertion caused need for more oxygen. As I would bend over to make an adjustment I would feel the need for more of it. The instruments in the cockpit and objects on the ground became dim and shaky. An altitude flight is a continual study of one's physical and mental condition. It is a problem of how far one can go without collapse. I was worried at no time until approximately 39,000 feet (indicated) was reached, when ice from my breath must have clogged the oxygen pipe for its force diminished and I felt very bad effects from its lack.

"I tried to blow through the tube and got a taste of ice, but could not recover the needed supply, so I swung over onto the emergency flask and tore a small plaster from the side of my mask, inserted the tube from that tank directly into my mouth and in a moment was normal again.

"I thought I might be able to reach 7000 or 8000 feet more because I was then supercharging at 40,800 feet (indicated) and thought I could go higher on the engine alone, but this was impossible. As soon as sea level conditions were lost in the motor I could get only 400 feet more, and this was the absolute ceiling of the plane.

"While hanging suspended at an altitude of 41,200 feet the plane swung and rolled, and very little action on the controls could be obtained. They were almost useless, as there was not enough sustaining surface to move the plane in the direction desired. It hung practically without control, and I held it there for almost five minutes before I made sure it would go no higher. Then I pulled back the throttle slightly in order to glide down. Even with this small movement the bottom seemed to drop out of the machine and down it plunged.

"I had been making a wide circle over Dayton. As altitude was gained I

made a circle with a radius of 60 or 70 miles. I did not pay much attention to direction as I dropped the first 10,000 feet, but at 30,000 I began to feel normal and changing my goggles glided toward the earth, stopping at 20,000 feet for about 20 minutes to accustom myself to the change in pressure."

Lieutenant Macready found the temperature 58 degrees below zero at the peak of his climb.

THE PULITZER TROPHY RACE

When Bert Acosta piloted the Curtiss-Navy biplane across the finish line in the Pulitzer Trophy Race at Omaha, Nebr., Nov. 3, he had covered 153.59 miles at an average speed of 176.7 miles an hour—about 260 feet a second—and had broken all records for speed over a closed course. That particular Curtiss entry had torn through space an average of 3.7 miles an hour faster than the Nieuport-Delage *Sesquiplane* in which Georges Kirsch had won the first Deutsche de la Meurthe Trophy and created a new world's record at Etampes, France, Oct. 1. Thus in a month and three days did America snatch from Europe the most coveted of all aeronautical laurels, the international closed course speed record.

The Pulitzer Trophy course this year was triangular and included twelve, eleven and seven mile straightaways. This made five complete laps in the race. Acosta said that on the twelve miles straightaway, with the soft Indian Summer breeze helping him along, he had made a speed of more than 200 miles an hour. During the entire race he did not rise more than 500 feet from the ground.

Thousands cheered themselves hoarse at the gallant performance of plane and pilot, which was not without keen competition. Clarence Coombs, driving the Curtiss built *Cactus Kitten* for S. E. J. Cox of Houston, Tex., who first entered the plane in the Gordon Bennett races in 1920, had an even chance with Acosta when the race began. Many believed the *Cactus Kitten* was the faster plane, faster, all points considered, by six miles an hour. Coombs, however, had never flown the *Cactus Kitten*, and the plane itself had never been opened wide in a race. To the spectators it was apparent that Coombs was not able to get the most out of his machine in rounding the pylons, for he made wide turns at varying heights and probably traveled 25 miles more during the race than did the others. So great was the speed of the Curtiss-Cox entry, however, that Coombs won second place, averaging 170.26 miles an hour. Even at second Coombs maintained a faster speed than any other had ever flown on this hemisphere. C. C. Moseley, who won last year's Pulitzer Race in a Verville Packard, averaged 156.5 miles an hour, according to a corrected survey of the course made after the race.

Next to the winning plane the prettiest performance was that of the Thomas-Morse M.B.-6 biplane, with its three hundred horse-power Wright motor. It was piloted by Lt. J. A. Macready, holder of the world's altitude record. He was on furlough from the Air Service and flew for the builders of the craft. His average speed was 160.71 miles an hour. The fourth and last plane to finish was the Aero Import Corporation's entry, an A.-1 Balilla, powered with a Curtiss No. 12 four hundred horse-power engine, similar to the motors in the Curtiss-Navy and Curtiss-Cox entries. The Balilla was piloted by Lloyd Bertaud, who, unlike the others, made picturesque turns around the home pylon. Admittedly entered with one of the slowest planes in that race, Bertaud's average speed was 149.78 miles an hour.

Two others who started failed to finish. One was James Curran, piloting for Ralph C. Diggins of Chicago. Sheer sportsmanship caused them to start, for after the entries had been taxied onto the starting line they knew their S.V.A. had not been built for such speed as the other promised. Curran dropped out after the others finished. There was more sportsmanship to follow, however. Harold E. Hartney, who had won second place with a Thomas-Morse plane in the 1920 Pulitzer Race, flew a new model monoplane produced by the same company. Failure of the gasoline pump forced a landing, injuring Hartney.

J. L.-6 MONOPLANE'S RECORD ENDURANCE FLIGHT

Under conditions which a few years ago would have been regarded as utterly impossible, Eddie Stinson and Lloyd Bertaud of the J.L. Aircraft Corporation, New York, on Dec. 29, 1921, took a J.L.-6 all-metal monoplane (185 h.p. BMW motor) into the air over Roosevelt Field, Long Island, and kept it there 26 hours, 19 minutes and 7 seconds.

The J.L.-6 went up at 8:58 o'clock on the morning of the 29th in a snowstorm. The plane was loaded with 350 gallons of gas and 23 gallons of oil, with a total weight of 5400 pounds. An official party of observers from the Aero Club of America took turns observing the plane during the day and night. The snow continued to fall heavily during the first few hours, the plane flying at the low altitude of 500 feet. In the afternoon the wind freshened into a twenty-five mile gale and the thermometer fell to 5 degrees F. By evening the wind had increased to forty miles an hour. During the morning's snowstorm the pilots had kept close to the field, making a short six-mile circuit.

Later they maintained an altitude of 2000 feet, and a long circuit was made, reaching from Farmingdale to Garden City. The gale continued at full blast all night, the temperature registering zero. To guide the pilots, four lights were kept burning, placed in the form of an arrow, three flares at the head and another flare 100 feet to the south, making an arrow pointing due north. Although the plane was invisible during the night, the hum of the motor was continually heard. At times the machine was discernible by the occasional flares from the exhaust or as a dark shade moved by directly overhead.

Morning found the monoplane making north-and-south laps, from the north end of Mitchel Field to a point some four miles south. The wind was still strong, and the plane virtually hung stationary at times. Too much credit cannot be given the pilots, Stinson and Bertaud, for the masterly way in which they handled their craft.

Finally, at 11:17 a. m. on the 30th, the machine broke away from its monotonous encircling flight and glided down to Roosevelt Field, Stinson and Bertaud climbed out of the pilots' cockpit, hungry and cold but smiling and happy. Bertaud wore a fur-lined flying suit, not electrically heated, and he was much affected by the cold. Stinson, with nothing heavier than overalls and a sheep-lined coat over his ordinary clothes, seemed more comfortable although four of his fingers were frost-bitten. Arrangements had been made to keep the cabin warm, for use by the pilot off duty, but at the last moment plans were changed to accommodate empty fuel cans. As a result, neither of the pilots had availed himself of the cold, blastly cabin, both remaining in their seats throughout the flight.

The aviators later explained that since 3 o'clock that morning they had been having trouble with the oil system, and that the pump had finally gone out of commission. Stinson's fingers had nearly frozen when he removed his gloves and fashioned a temporary feed tube leading from a hole they had punctured in the tank. They took turns handling the controls of the plane and feeding oil into the auxiliary tank. There was sufficient gasoline left in the machine when it alighted to keep it up five hours longer, the pilots said. The faulty oil supply system and the intense cold made this impossible, however.

REMARKABLE AERONAUTICAL PERFORMANCES

(For Performances prior to 1920, see "Aircraft Year Book, 1921.")

1920

- May 17 Clarence Coombs and three passengers, in an *Orenco* Tourister equipped with a 150 h.p. Wright engine, made an altitude record of 17,150 feet.
- May 22 A Dayton Wright Model O.W. "*Aerial Coupe*" piloted by B. L. Whelan with three passengers made an altitude flight of 19,710 feet at Dayton, O. The flight covered 2 hours 31 minutes.
- May 26 Lt. Harry Weddington with three passengers made an altitude flight of 20,081 feet at Kelly Field.
- June 27 Larsen J.L.-6 monoplane made a non-stop flight of 1200 miles from Omaha, Nebraska, to Lancaster, Pa., in 12 hours 52 minutes flying time. Bert Acosta was the pilot and he carried 2 passengers.
- Aug. 15 Laura Bromwell broke the women's loop-the-loop record at Curtiss Field, with an official total of 87 loops.
- Oct. 20 Four U. S. Army D.H.-4's completed a round trip flight to Alaska and back. The planes left Mitchel Field on July 15 and arrived at Nome on Aug. 25. The aviators left Nome on Aug. 29. In all, a total distance of 4345 miles was made in 112 flying hours.

RECORDS, ETC. WORLD AERONAUTICAL RECORDS, 1921

See also Aircraft Year Book for 1921

All records to be official must be homologated by the Federation Aéronautique Internationale. The Aero Club of America is the official representative of the F. A. I. in the United States and homologates the American records. These records are all official records of the F. A. I. and represent the latest record in each case.

(B, biplane; M, monoplane; T, triplane.)

For previous records see Aircraft Year Book, 1921. pp. 276-81.

ALTITUDE

<i>Name</i>	<i>Airplane</i>	<i>Engine</i>	<i>Place</i>	<i>Date</i>	<i>Height</i> <i>Metres</i>	<i>Feet</i>
B J. S. Macready	Lepere	400 h.p. Liberty with superchargers	Dayton	Sept. 28, 1921	10,518	34,563

DISTANCE

B Bousoutrot & Bernard	Farman Goliath	2-260 h.p. Salmson	Villesauvage	June 3-4, 1920	<i>Metres</i> 1190	<i>Miles</i> 1915
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DURATION

B Stinson & Bertaud	Larsen J.L.-6	185 h.p. B.M.W.	Roosevelt Field, L. I.	Dec. 29-30, 1921	<i>Hours</i> 26	<i>Time</i> <i>Min.</i> 19	<i>Sec.</i> 35
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SPEED

DISTANCE OF 1 KILOMETER (STRAIGHT LINE)

B Leconte	Nieuport Delage	300 h.p. Hispano Suiza	Paris	Sept. 26, 1921	<i>Speed Per Hour</i> <i>Metres</i> 330.275	<i>Miles</i> 205.223
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SPEED OVER 100 KILOMETER COURSE (62.15 MILES)

B Brackpapa	Fiat	700 h.p. Fiat	Villesauvage	Oct. 1, 1921	<i>Time</i> <i>Min.</i> 20	<i>Speed</i> <i>Secs. per hr.</i> 5 2/5 185.58mi.
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Name	Airplane	Engine	Place	Date	Time		Speed
					Min.	Secs.	
B Kirsch	Nieuport Delage	300 h.p. Hispano Suiza	Villesauvage	Oct. 1, 1921	42	39 4/5	174.77mi.
* B*Acosta							
	Curtiss-Navy	SPEED OVER 248.65 KILOMETER COURSE (153.59 MILES) Curtiss C.-12	Omaha, Nebr.	Nov. 3, 1921	52	9	176.7mi.
B Boussoutrot & Bernard							
	Farman Goliath	2-260 h.p. Salmons	Villesauvage	June 3-4 1920	Time Speed per Hrs.Min.Sec. hr.		
					10	19 46	60.155
B Boussoutrot & Bernard							
	Farman Goliath	SPEED OVER 1500 KILOMETER COURSE (932.356 MILES) 2-260 h.p. Salmons	Villesauvage	June 3-4 1920	16	42 8	55.804
B leBoucher							
	Breguet Rateau	USEFUL LOAD CARRIED (WITH 250 KILOGRAMS) ALTITUDE 280 h.p. Renault	France	July 6, 1921	Height Load Metres Feet		
							250 kgs. 6,782
B Hill							
	Handley Page W-8	USEFUL LOAD CARRIED (WITH 1500 KILOGRAMS) ALTITUDE 2-450 h.p. Napier	Cricklewood, England.	May 4, 1920			1500 kgs. 4,267 13,999
B Hill							
	Handley Page W-8	USEFUL LOAD CARRIED (WITH 1500 KILOGRAMS) DURATION 2-450 h.p. Napier	Cricklewood, England.	May 4, 1920	Time 1500 kgs. Hours Mins.		
						I 20	

*Not a F.A.I. Record, but a World Record.

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